MP1763B
Pulse Pattern Generator
Operation Manual

Sixth Edition

Read this manual before using the equipment.
Keep this manual with the equipment.

Measuring Instruments Division
Measurement Group
ANRITSU CORPORATION

MAR.
1998

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Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Insure that you clearly understand the meanings of the symbols BEFORE using the equipment.
Some or all of the following symbols may not be used on all Anritsu equipment. In addition, there may be other labels attached to products which are not shown in the diagrams in this manual.

Symbols Used in Manual

DANGER	This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.
WARNING	This indicates a hazardous procedure that could result in serious injury or death if not performed properly.
CAUTION	This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and/or in Manual

The following safety symbols are used inside or on the equipment near operation locations, and/or in manual to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.

This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.

This indicates warning or caution. The contents are indicated symbolically in or near the triangle.

This indicates a note. The contents are described in the box.

These indicate that the marked part should be recycled.

MP1763B
Pulse Pattern Generator
Operation Manual

30 August 1995 (First Edition)
12 March 1998 (Sixth Edition)

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For Safety

WARNING

1. **ALWAYS refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.**
   Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.

2. **When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, before supplying power to the equipment, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.**

Repair

WARNING ⚠

3. **This equipment cannot be repaired by the user. DO NOT attempt to open the cabinet or to disassemble internal parts. Only Anritsu-trained service personnel or staff from your sales representative with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision parts.**

Falling Over

4. **This equipment should be used in the correct position. If the cabinet is turned on its side, etc., it will be unstable and may be damaged if it falls over as a result of receiving a slight mechanical shock.**

CAUTION

Changing Fuse

CAUTION ⚠

1. **Before changing the fuses, ALWAYS remove the power cord from the poweroutlet and replace the blown fuses. ALWAYS use new fuses of the type and rating specified on the fuse marking on the rear panel of the cabinet.**

   T___A indicates a time-lag fuse.
   ___A or F___ A indicate a normal fusing type fuse.
   There is risk of receiving a fatal electric shock if the fuses are replaced with the power cord connected.

Cleaning

2. **Keep the power supply and cooling fan free of dust.**
   - **Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.**
   - **Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.**

3. **Use two or more people to lift and move this equipment, or use a trolley. There is a risk of back injury, if this equipment is lifted by one person.**

Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories including the Electrotechnical Laboratory, the National Research Laboratory and the Communication Research laboratory, and was found to meet the published specifications.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within 1 year after shipment due to a manufacturing fault, provided that this warranty is rendered void under any or all of the following conditions.

- The fault is outside the scope of the warranty conditions described in the operation manual.
- The fault is due to misoperation, misuse, or unauthorized modification or repair of the equipment by the customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster including fire, flooding and earthquake, etc.
- The fault is due to use of non-specified peripheral equipment, peripheral parts, consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation will not accept liability for equipment faults due to unforeseen and unusual circumstances, nor for faults due to mishandling by the customer.

Anritsu Corporation Contact

If this equipment develops a fault, contact Anritsu Corporation or its representatives at the address in this manual.

Storage medium

This instrument uses floppy disks for storing data and programs.

Incorrect use of the floppy disks or errors can cause the data stored on the medium to be erased.

Back up the floppy disk as a precaution.

Anritsu will not compensate for loss of the stored data.

Note the following points when using this instrument. Especially, do not remove the floppy disk from the drive during disk access. For details, see the main text of this manual.

- Satisfy the specified environmental conditions. Do not use this instrument in ;laces subject to dirt.
- Keep floppy disks away from magnetized products. Do not bend the floppy disk.

Disposing of the product

The MP1763B uses chemical compound semiconductor including arsenic and timer including manganese dioxide Lithium Battery and mercury.
At the end of it's life, the MP1763B should be recycled or disposed properly.

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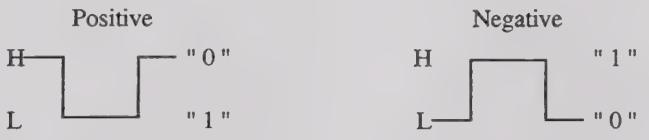
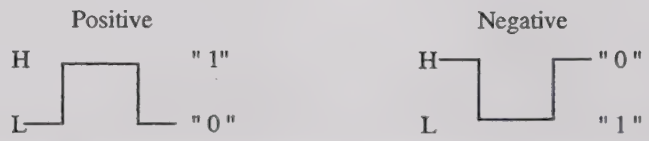
SECTION 1
GENERAL

1.1 Features

The MP1763B Pulse Pattern Generator has two data output channels (DATA and $\overline{\text{DATA}}$) and three clock output channels (CLOCK1, $\overline{\text{CLOCK1}}$, CLOCK2). The MP1763B is used with the MP1764A Error Detector to test high-speed digital communication systems and high-speed semiconductors. It operates over the 50 MHz to 12.5 GHz frequency range and generates four pulse patterns: alternate, programmable, zero substitution, and pseudorandom. Programmable DATA pattern can generate data up to 8 M bits and send six STM-64(OC192) frames.

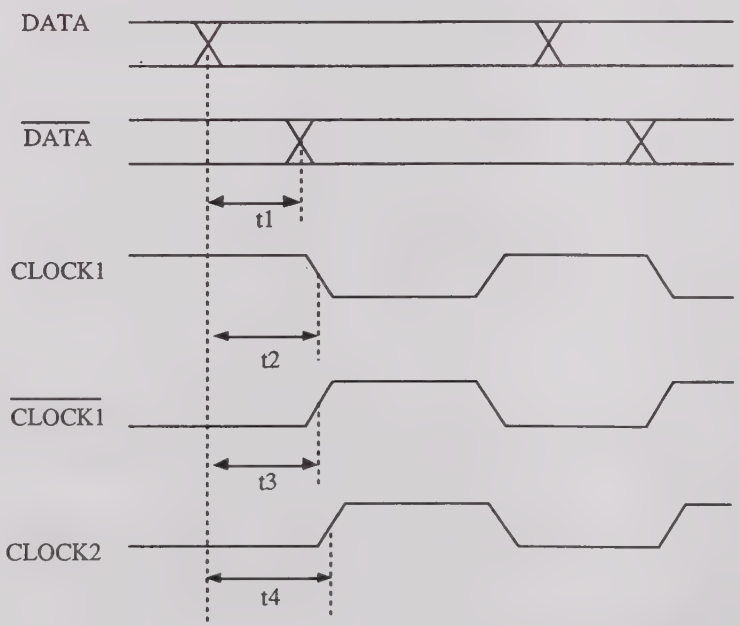
There are also seven 2^N-1 (N=7, 9, 11, 15, 20, 23, 31) pseudorandom patterns. The pseudorandom pattern mark ratio can be selected from among 0/8, 1/8, 1/4, 1/2, $\overline{1/2}$, 3/4, 7/8, and 8/8. Both 50Ω GND and ECL outputs are supported. The offset and level can be varied. The clock (CLOCK1, $\overline{\text{CLOCK1}}$) delay can also be adjusted by ±500ps in 1ps steps.

1.2 Specifications

Operation frequency range	Internal Clock (OPTION 01)		0.05 to 12.5 GHz
	External Clock		0.05 to 12.5 GHz
Pattern generation	PRBS	Pattern length	2^N-1 (N=7,9,11,15,20,23,31)
		Mark ratio	1/2,1/4,1/8,0/8 ($\overline{1/2}$,3/4,7/8,8/8 also possible by logic inversion)
		Number of "AND bit" shifts when setting mark ratio	1 bit or 3 bits (Selectable using rear panel DIP switch)
	Zero substitution		Continuous 0 pattern can be inserted up to pattern length -1. Patterns: 2^7, 2^9, 2^{11}, 2^{15}
	DATA	DATA length	2 to 8388608 bits 2 to 65536 : Step 1 bit 65536 to 131072 : Step 2 bits 131072 to 262144 : Step 4 bits 262144 to 524288 : Step 8 bits 524288 to 1048576 : Step 16 bits 1048576 to 2097152 : Step 32 bits 2097152 to 4194304 : Step 64 bits 4194304 to 8388608 : Step 128 bits
		Edit function	All 0 / All 1 / Page 0 / Page 1
	Alternate pattern		Number of patterns A and B to be output can be specified. Patterns A and B must be the same length.
		Output control	Internal/external switchable
		A/B switching	A/B each 1 to 127 times/step 1
		DATA length	128 to 4194304 bits/step 128 bits
		Edit function	All 0 / All 1 / page 0 / page 1
	Logic inversion		Positive / Negative switching possible [PRBS]  [PRGM] 

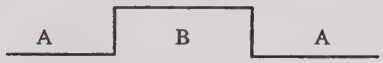
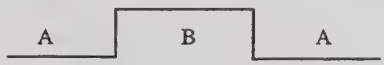
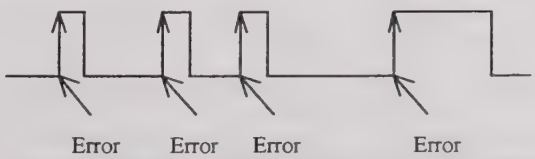
Pattern generation	Error insertion	Internal	Error ratio	1×10^{-n} or single (n = 4, 5, 6, 7, 8, 9)
			Insertion position	Insertion possible at any one of 32 channels (Rear panel swith)
		External	Eror injection	Error insertion by rising edge of external signal input
			Insertion position	Insertion possible at any one of 32 channels (Rear panel switch)
			DISABLE function	Error insertion when external signal input level is "H"
			Error ratio	1×10^{-n} or single (n = 4, 5, 6, 7, 8, 9)
			Insertion position	Insertion possible at any one of 32 channels (Rear panel switch)
	Gating input			DATA is set to "0" while external signal input level is "L".
External Clock Input	Frequency range			0.05 to 12.5 GHz
	Input level			0.4 to 2.5 Vp-p
	Input waveform			0.05 to 0.5GHz : Square wave only > 0.5 GHz: Sine wave or square wave (duty 50%)
	Input impedance			50 Ω
	Connector			SMA
Clock output	Number of outputs			CLOCK1/$\overline{\text{CLOCK1}}$, CLOCK2 3 systems
	CLOCK1 / $\overline{\text{CLOCK1}}$	Delay range		±500ps/1ps step
		Amplitude		0.25 to 2.0 Vp-p/Step 2 mV Setting error: ±15% (1.5 to 2.0 Vp-p), ±25% (0.5 to 1.5Vp-p), ±100 mV(0.25 to 0.5 Vp-p)
		Offset		-2.0 to 2.0 V (VOH) /Step 1 mV Setting error: ±15% or ±15% of Amplitude, and±100 mV, whichever is larger
		Rise/fall times (10%–90%)		≧ 8 GHz 1.5 to 2 Vp-p 35ps or less < 8 GHz 1.5 to 2 Vp-p 50ps or less ≧ 8 GHz 1.0 to 1.5 Vp-p 40ps or less < 8 GHz 1.0 to 1.5 Vp-p 55ps or less ≧ 8 GHz 0.25 to 1.0 Vp-p 45ps or less < 8 GHz 0.25 to 1.0 Vp-p 60ps or less
		Waveform distortion		15% or less or 150 mV, whichever is larger
		Duty ratio adjust function		Duty ratio can be adjusted by semifixed variable resistor
		Load impedance		50 Ω (with back termination)
		Termination		50 Ω/GND, 50 Ω/–2 V
		Connector		APC-3.5
	CLOCK2	Output level		VOH : 0±200 mV Amplitude: 1 Vp-p ±35%
		Load impedance		50 Ω (without back termination)
		Connector		SMA

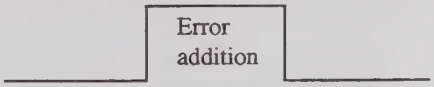
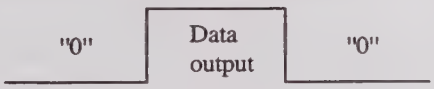
DATA output	Output waveform	NRZ
	Number of outputs	DATA, $\overline{\text{DATA}}$ 2 systems independence
	Amplitude	0.25 to 2.0 Vp-p/Step 2 mV Setting error: ±15% or ±100 mV, whichever is larger
	Offset voltage	–2.0 to 2.0 V (V_{OH}) /Step 1 mV Setting error: ±15% or ±15% of Amplitude , and ±100 mV, whichever is larger
	DATA/$\overline{\text{DATA}}$ Tracking	Amplitude and offset of DATA and $\overline{\text{DATA}}$ can be set to the same value.
	Rise / fall time	≧5 GHz 35ps or less (10-90%) < 5 GHz 45ps or less (10-90%)
	Pattern jitter	20ps or less (p-p)
	Waveform distortion	1.8 Vp-p≦amplitude: 10% or less 1.5 Vp-p≦amplitude < 1.8 Vp-p: 12% or less Amplitude < 1.5 Vp-p: 15% or less, or 150 mV or less, whichever is larger.
	Termination	50Ω/GND, 50Ω/–2 V
	Load impedance	50Ω (with back termination)
	Connector	APC-3.5
Output phase		



| t1| ≦30ps
| t2| ≦30ps
| t3| ≦30ps
| t4| ≦30ps

CLOCK1/$\overline{\text{CLOCK1}}$ delay set to 0ps

1/8 output	Number of output	8 data outputs, 1 clock output
	Data polarity	Same as 1/1 DATA
	Output level	ECL (H: –0.9 ±0.25 V, L: –1.75 ±0.25 V)
	Rise / fall time	300 ps or less (20-80%)
	Pattern jitter	100 ps or less (p-p)
	Waveform distortion	15% or less
	Skew	150 ps or less (relative to falling edge of 1/8 clock)
	Output bit rate	1/8 of fundamental frequency
	Load impedance	50Ω
	Connector	SMA
Sync. output		Switching of 1/64 CLOCK, Fixed position pattern sync, and Variable position pattern sync.
	Output level	V_{OH}: 0±200 mV Amplitude: 1 Vp-p±20%
	Load impedance	50Ω
	Connector	SMA
Alternate pattern A/B switching input		ALTN patterns A/B switching controlled by external signal 
	Minimum pulse width	$\frac{1}{\text{Fundamental frequency}} \times$ Data length
	Input level	ECL (H: –0.9 ±0.2 V, L: –1.75 ±0.2 V)
	Input impedance	50Ω
	Connector	SMA
Alternate pattern A/B switching output		ALTN patterns A/B switching signal output 
	Output level	ECL (H: –0.9 ±0.2 V, L: –1.75 ±0.2 V)
	Output impedance	50Ω
	Connector	SMA
Error injection input		Error inserted at rising edge by external signal 
	Minimum pulse width	$\frac{1}{\text{Fundamental frequency}}$ x 32
	Input level	0/–1 V
	Input impedance	50Ω
	Connector	SMA

Error Disable input		Error ON/OFF controlled by external input signal  Error rate can be selected over this range
	Input level	0/-1 V
	Input impedance	50Ω
	Connector	SMA
External Gating input		Output data control by external signal 
	Minimum pulse width	$\frac{1}{\text{Fundamental frequency}} \times 32$
	Input level	0/-1 V
	Input impedance	50Ω
	Connector	SMA
Parameter memory	Medium	3.5 inch FD, 2HD, 2DD by 3 mode support
	Format	MS-DOS format (IBM-PC/NEC-PC selectable by rear panel DIP switch)
	Stored data	Programmable pattern/others
	Mode switching	Format, save, recall, resave, delete, search
Display	Display switching	V_{OH}, V_{TH}, V_{OL} switchable
	Panel lock	Disables all keys other than power switch.
External control	GPIB interface for one system	
GPIB	GPIB connector for external control	
Initialization	Inirialized by Local + Power on	
Operating temperature range	0 to 50℃	
Insulation resistance	2MΩ or more at 500 V	
Dielectric strength	1.5 kV, for 1 minute	
Power requirement	100 V system: 85 to 132 V Frequency 50/60 Hz±5% 700 VA or less	200 V system: 170 to 250 V
Dimensions & weight	221.5±4H×426±5W×451±5D, 33 kg or less	

Option-01	Name	Internal synthesizer
	Frequency range	0.05 to 12.5 GHz
	Output level	0.5 to 2.3 Vp-p
	Resolution	1 kHz/1 MHz (switchable)
	Frequency accuracy	1ppm (* When synchronized with external signal, accuracy is determined by external signal.)
	Reference signal	10 MHz (internal/external switchable)
	Signal purity	SSB phase noise (10 kHz offset, bandwidth 1 Hz) 0.05 ≦ Freq. < 2.0 GHz –90 dBc 2.0 ≦ Freq. < 4.0 GHz –85 dBc 4.0 ≦ Freq. < 8.0 GHz –80 dBc 8.0 ≦ Freq. <10.0 GHz –75 dBc 10.0 ≦ Freq. ≦12.5 GHz –70 dBc
	Spurious radiation	At clock output terminal Nonharmonic –70 dBc or less (off carrier 10 kHz or more) Power supply –40 dBc or less
	Load impedance	50 Ω
	Connector	SMA
Option-03 *	Name	1/4 SPEED OUTPUT
	Number of output	4 data outputs, 1 clock output
	Output bit rate	1/4 of fundamental frequency
	Data polarity	Same as 1/1 DATA
	Termination	50 Ω/GND, 50 Ω/–2 V
	Amplitude	0.5 to 2.0 Vp-p/Step 2 mV Setting error: ±15% or ±100 mV, whichever is larger
	Offset voltage	–1.5 to +1.5 V (V_{OH})/Step 1 mV Setting error: ±15% or ±15% of Amplitude, and ±100 mV, whichever is larger
	Rise/fall time	150ps or less (20-80%)
	Pattern jitter	100ps or less (p-p)
	Waveform distortion	15% or less
	Skew	The 1/4 data cross point is within ±100ps relative to the falling edge of the 1/4 clock.
	Output impedance	50 Ω
	Connector	SMA

* When OPTION 03 is installed, there is no 1/8 output.

1.3 Options

The following options are available:

OPTION 01 Internal synthesizer
OPTION 03 1/4 SPEED OUTPUT

1.4 Composition

The standard composition of the MP1763B Pulse Pattern Generator is shown in Table 1.4-1.

Table 1.4-1 MP1763B Standard Composition

Item	No.	Name	Qty	
Main Unit	MP1763B	MP1763B Pulse Pattern Generator	1	
Accessory	J0500A	Semirigid cable (50cm)	2	
	J0672E	Semirigid cable (10cm)	1	
	J0496	Conversion connector	4	APC • 3.5J-APC • 3.5J
	J0693	SMA cable (1m)	1	
	J0491	Shield power cord	1	13A (2.6m)
	J0008	GPIB cable (2m)	1	408JE-102
	F0071	Fuse (100V)	2	MF51NR8A
	F0014	Fuse (200V)	2	T6.3A250V
	Z0168	3.5 inch floppy disk (2HD)	2	Formatted *
	Z0306A	Wrist strap	1	
	M-W1023AE	Operation manual	1	
	M-W1024AE	GPIB Operation manual	1	
Application parts	MB24B	Caster		with 20A power cord/plug
	B0163	Portable carrying case		
	B0171	Protective carrying case		
	B0044	For mounting kit 1MW • 5U		2 pcs/set

* The capacity of the formatted type is 1,440 kilobytes. The quasi PRBS2^{10}–1 patterns (mark ratio 1/2, 1/4, 1/8) are saved on one floppy disk.

SECTION 2
PREPARATIONS

2.1 Environmental Conditions of Installation Site

Do not use and store the instrument in the following locations:

- where vibrations are severe.
- where it is damp or dusty.
- where there is exposure to direct sunlight.
- where there is exposure to active gases.

Long-term storage at high temperatures will shorten the life of the internal battery. Store the instrument below normal room temperature.

Operating temperature range	0℃ to 50℃ (However, 5℃ to 40℃ for floppy disks).
Storage temperature range	-40℃ to 70℃

2.2 Safety Measures

- Use the attached power cord to connect the AC power supply. Ground the ground terminal of the power cord or the frame ground terminal on the rear panel of the instrument.
- When changing the fuse, always use a fuse of the same rating. (See the fuse replacement item.)
- If the instrument is operated at room temperature after being used or stored for a long time at low temperature, condensation may occur and cause short-circuiting. To prevent this, do not turn the power on until the instrument completely dry.

2.3 Power Supply Voltage

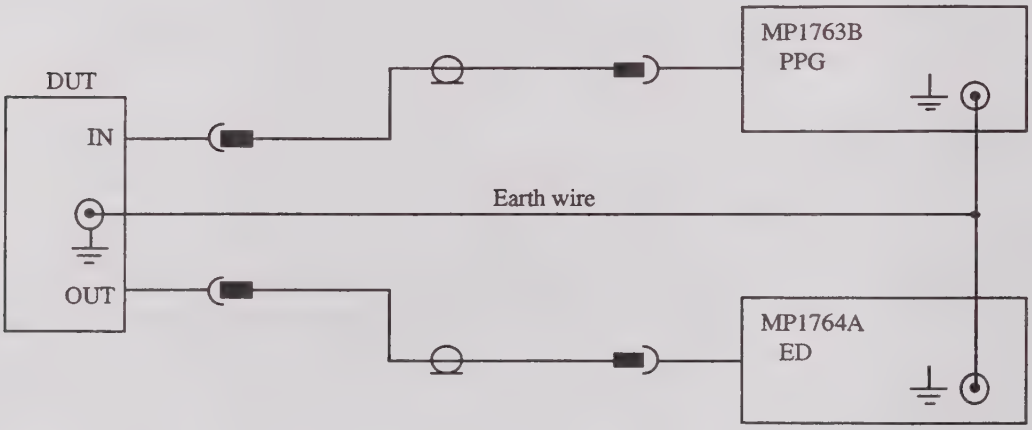
The power supply voltage for this instrument is shown on the rear panel. Use a voltage within the rated voltage range. Excessive voltage may damage the circuits.

2.4 Internal Battery Life

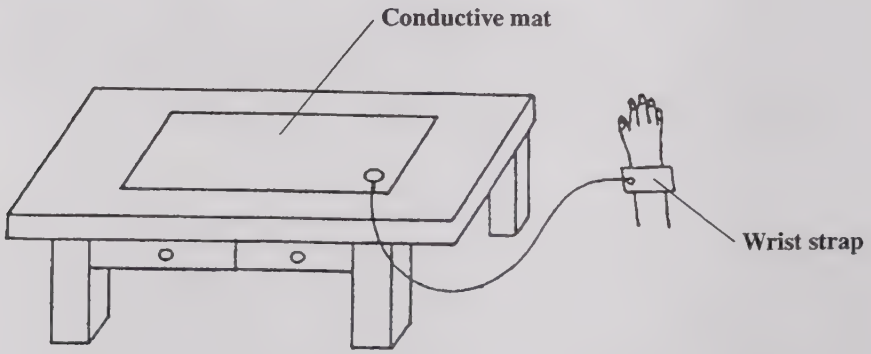
This instrument uses a lithium primary battery as the timer and memory back-up power supply. The life of this battery is 7years or more when the instrument is stored at normal room temperature. However, since the battery life largely depends on the storage temperature, storage at high temperatures for long periods will shorten the period above. Replace the battery of which period is exceeded. The internal battery cannot be recharged.

2.5 Damage Prevention Measures

- Do not apply an excessive voltage when inputting the signal to this instrument. The circuits may be destroyed.
- Terminate the output with 50Ω. Do not feed current to the output. The load must be a 50Ω pure resistor terminated at ground potential.
- Before connecting the input and output terminals, ground the other equipment (including test circuits) with a ground wire. (Static electric countermeasure)
- The outer and inner conductors of the coaxial cable may be charged as a capacitor. Therefore, discharge them with a piece of metal before using the cable.
- This instrument contains hybrid ICs and other important circuits and parts. These parts are extremely vulnerable to static electricity. Therefore, never remove the bottom cover.
- The hybrid ICs inside this instrument are hermetically sealed. Never break this seal. If the hybrid ICs are unsealed and the instrument deteriorates performance as specified, note that the maintenance may be refused.
- Ventilation holes are drilled into the bottom cover. Be careful not to block the ventilation.

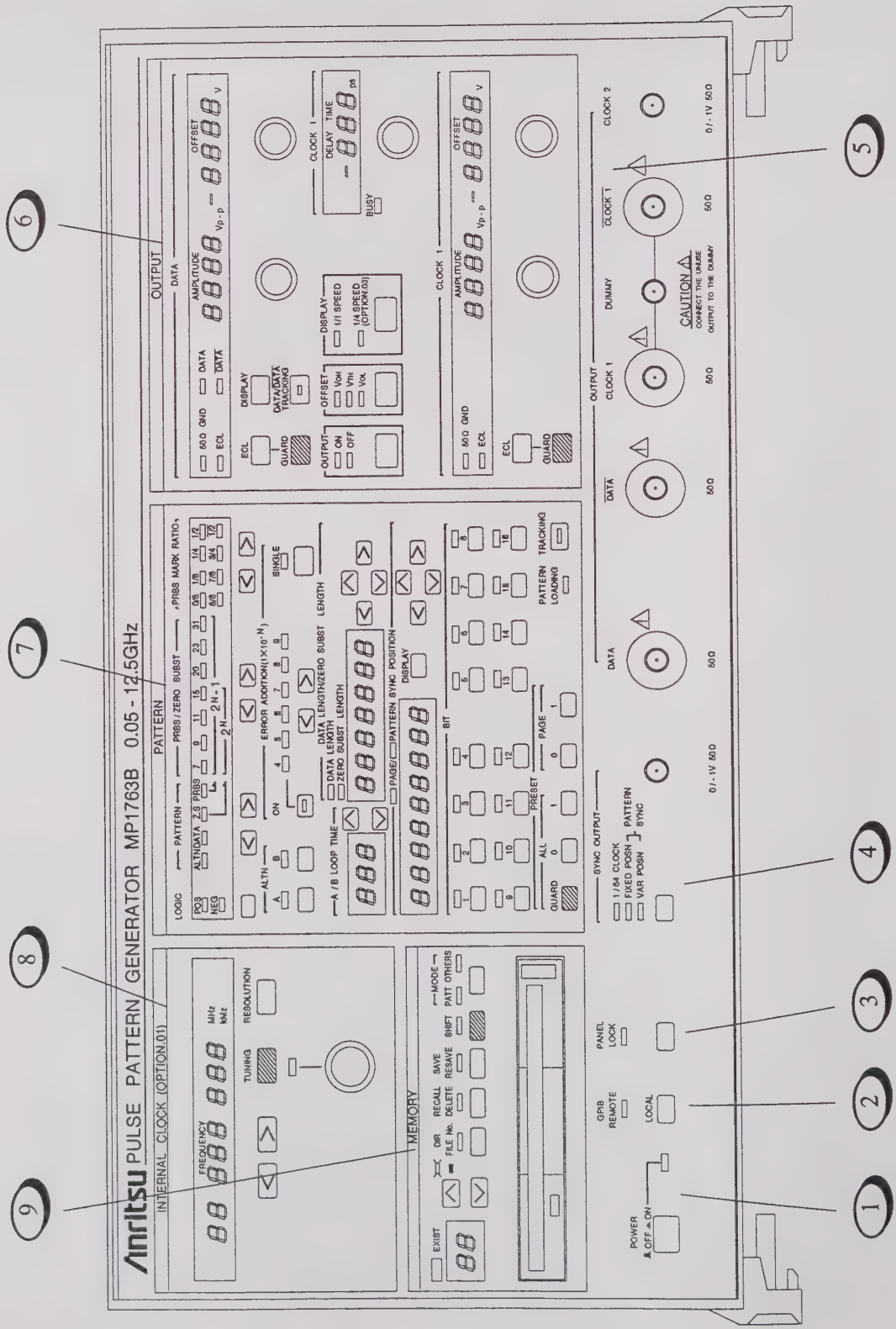


- To protect this instrument against electrostatic damage, place a conductive mat on the work bench, and wear a wrist strap. Connect the other end of the wrist strap to the conductive mat, or the GND terminal of this instrument.



SECTION 3
DESCRIPTION OF PANELS AND CONNECTORS

3.1 FRONT PANEL



(1) Power switch

When , the power is turned on and the LED goes on.

When , the power is turned off.

(2) LOCAL key

Switches from the GPIB REMOTE mode (LED lit) to the LOCAl (key operation possible) mode.

In GPIB REMOTE mode, all the keys other than the power switch and LOCAL key are ineffective.

(3) PANEL LOCK key

Panel lock (LED lit) disables all the keys other than the POWER switch and the PANEL LOCK key.

(4) SYNC OUTPUT keys

Select the type of SYNC OUTPUT.

1/64 CLOCK: Outputs a CLOCK divided by 64.

FIXED POSITION: Outputs a synchronization pulse at a fixed position to the output pattern.

VARIABLE POSITION: Shifts the synchronization pulse output position in 16 bits unit.

(5) Output connectors

DATA, $\overline{\text{DATA}}$	Output.
CLOCK1, $\overline{\text{CLOCK1}}$	Complementary CLOCK output.
CLOCK2	Auxiliary clock output.
DUMMY	Connects the unused side of the complementary output.

Note: If the unused side of the complementary output is opened, the output waveform on the side used will be degraded.

(6) OUTPUT condition block

Sets the output level, offset and termination conditions.

(7) PATTERN setting block

Sets the generated pattern type, logic, etc.

Performs error addition.

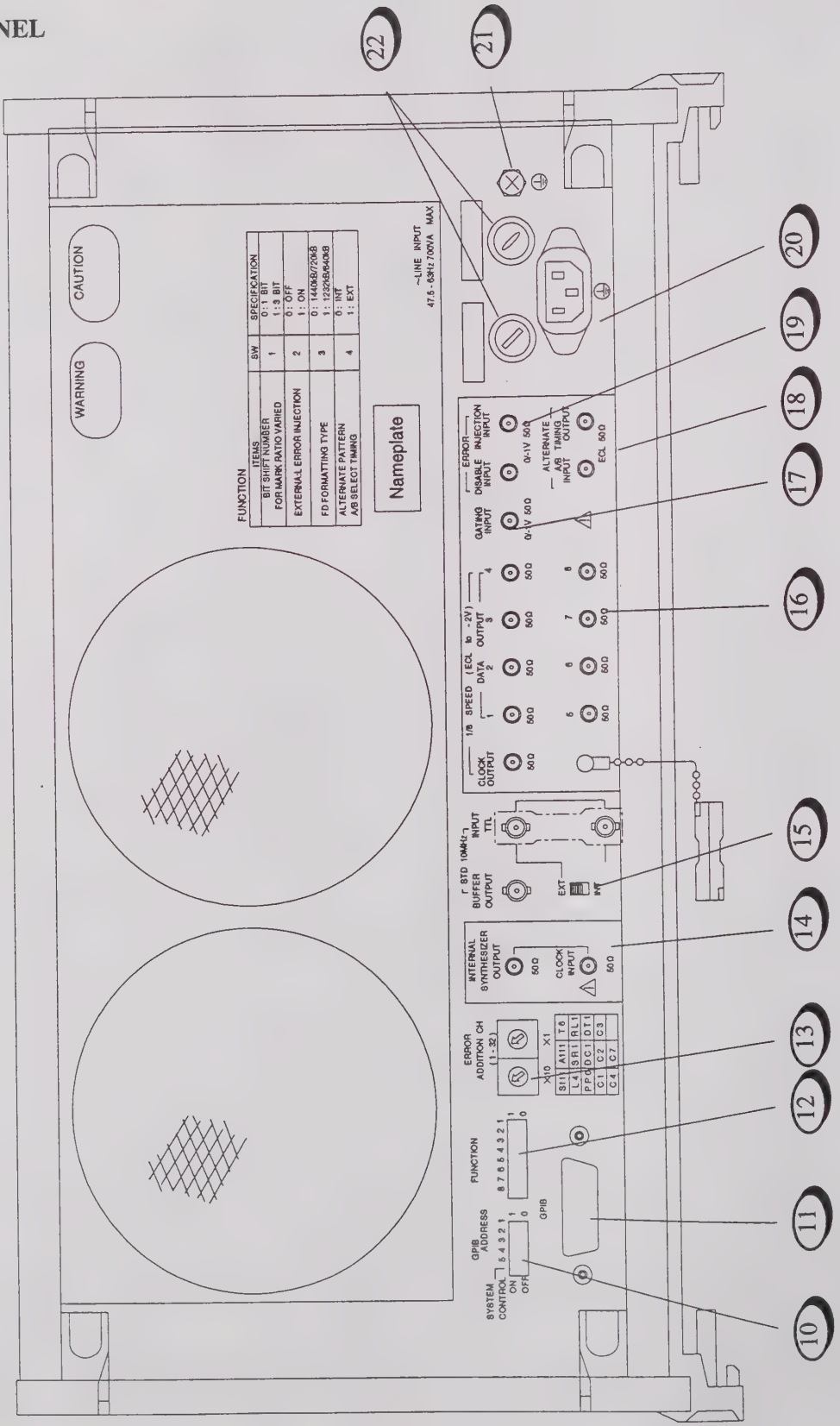
(8) Frequency setting block

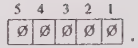
Sets the frequency when OPTION 01 installed.

(9) Floppy disk drive

Saves the set pattern and other conditions to a floppy disk.

3.2 REAR PANEL

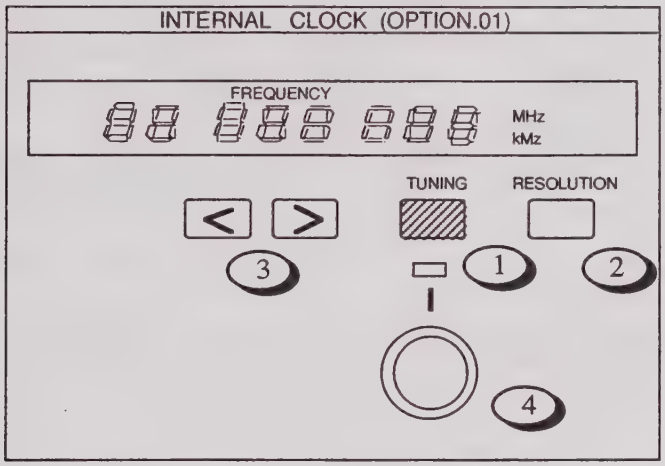


10	GPIB address Dip switch SYSTEM CONTROL switch	Sets the address when the instrument is remotely controlled by GPIB. It is usually set to  . When this switch is set to ' ON ' , this instrument control other one.
11	GPIB connector	Connector for GPIB cable. (The cable is connected when the instrument is remotely controlled by GPIB.)
12	FUNCTION Dip switch	It is possible to select functions noted rear panel.
13	Error ADDITION CH	Selects which of the 32 channels an error is to be added.
14	INTERNAL SYNTHESIZER OUTPUT	Internal CLOCK output connector when OPTION 01 installed.
	CLOCK INPUT	Clock signal input connector. (When the internal synthesizer is used, this connector is connected to the INT. SYNTHE. OUTPUT connector.)
15	STD 10 MHz	When OPTION 01 (internal synthesizer) is used, synthesizes the other signals and the internal synthesizer. 10 MHz TTL level
16	1/8 SPEED output connector	1/8 DATA and 1/8 CLOCK output connector (ECL level) Note: When OPTION 03 (1/4 SPEED OUTPUT) is installed, this connector becomes the 1/4 DATA, 1/4 CLOCK output connector.
17	GATING signal input connector	0/-1 V 50Ω
18	Alternate pattern A/B switching Timing I-O connector	ECL level 50Ω
19	Error addition control connector	0/-1 V 50Ω
20	Power inlet	
21	Ground terminal	Connected to the ground terminal of an instrument connected to this instrument.
22	Fuse holder	

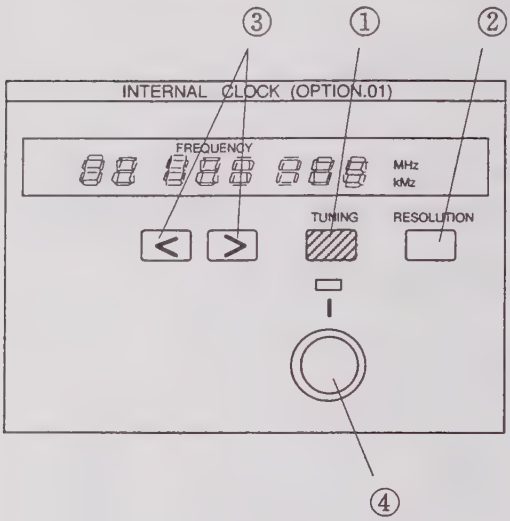
SECTION 4
OPERATING INSTRUCTIONS

4.1 Internal Clock Generator Frequency Setting (OPTION 01)

This section sets the frequency of the internal clock generator when the CLOCK generator (OPTION 01) is used.



1	TUNING ON/OFF	The frequency can be changed only when the TUNING LAMP is lit.
2	RESOLUTION	Used when setting the frequency down to the kHz order. Pressing this key again returns the setting to the MHz order.
3	< >	Select the digit to be changed. The figure of the digit to be changed blinks.
4		Used when changing the blinking digit. The figure is carried over.



① Press the TUNING key. The TUNING lamp lights. (The frequency can be changed only when the TUNING lamp is lit.) At this time, the figure of the digit that can currently be changed blinks.

② Press the RESOLUTION key and select whether the frequency is to be set in MHz or kHz.

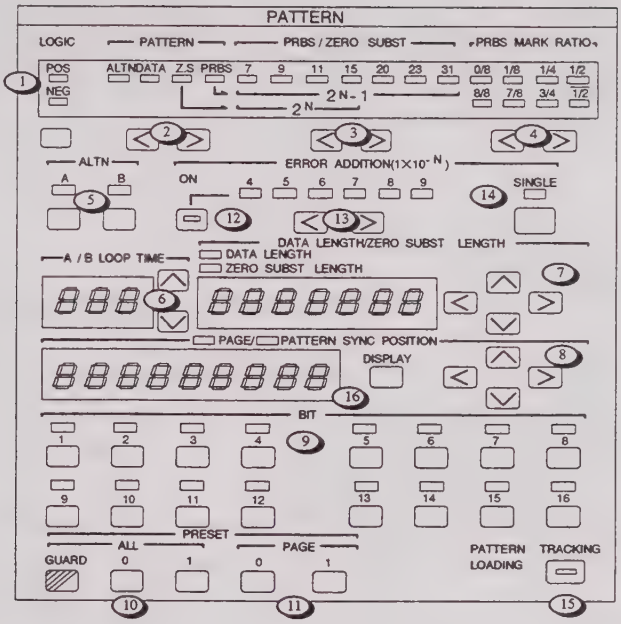
When the frequency can be set down to kHz, an 8-digit number is displayed. (Five digits for MHz.)

③ Select the digit to be changed with the < > keys. The figure of the digit that can be changed blinks.

④ Change the frequency by turning the rotary encoder.

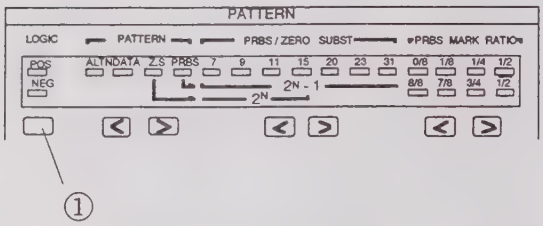
Note: The frequency may not be stable just after the power is turned on. Make a warm-up run for 10 minutes or longer before use.

4.2 Generation Pattern Setting



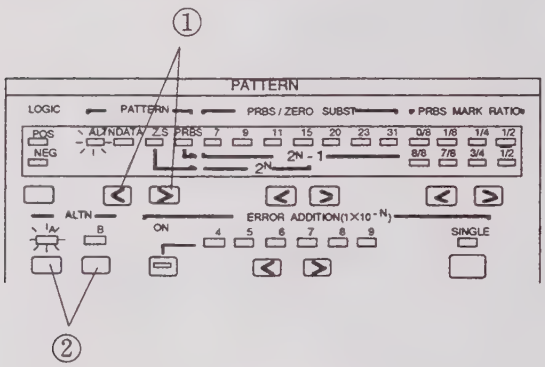
1	LOGIC	Inverts the output pattern logic.
2	PATTERN	Selects the output pattern type.
3	PRBS/ZERO SUB	Selects the kind of pseudorandom pattern. (If ZERO SUB is selected, the 2^N pattern is selected.)
4	Mark ratio	Selects the output pattern (pseudorandom pattern) mark ratio.
5	Alternate	Selects alternate pattern A or B.
6	Number of alternate loops	Sets the number of A or B pattern loops.
7	DATA length/continuous 0 bits length	Sets the DATA length. For Z.S., sets the continuous 0 bit length.
8	PAGE/pattern sync position	Sets the page selection (ALTN/DATA) and pattern synchronization position.
9	Bit setting	Sets the output pattern for each 16 bits.
10	Bit setting (special)	Sets all DATA to 0 or 1.
11	Bit setting (special)	Sets DATA to 0 or 1 in page units.
12	Error addition ON/OFF	Turns error addition on and off.
13	Error addition rate selection	Selects the error addition rate.
14	Single error addition	In the single error addition mode, one error is added each time this key is pressed.
15	Tracking ON/OFF	When tracking is turned on, the settings of the transmitter and receiver are changed at the same time (the one set as the master is followed by the other).
16	Display switching	Selects page display or pattern sync position display.

4.2.1 Logic modification



① The logic of the set pattern is changed in positive → negative → positive order each time the LOGIC key is pressed. (The set logic is indicated by lighting of a lamp.)

4.2.2 Alternate pattern setting



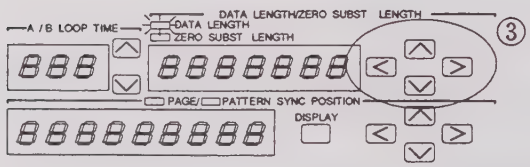
① Select ALTN with the ◁ ▷ keys.

(DATA, Z.S, and PRBS are also selected with these keys.)

ALTN → DATA → Z.S. → PRBS

ALTN ← DATA ← Z.S. ← PRBS

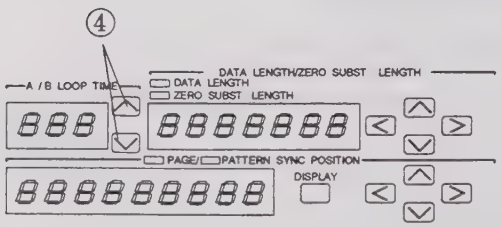
② Pattern A and pattern B are selected with this key. Since pattern A is set first, set this key so that the A lamp lights. (It does not matter which pattern is set first.)



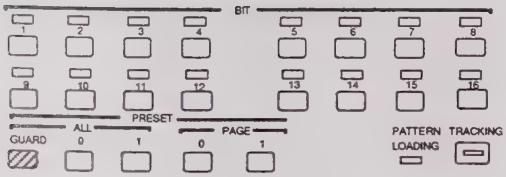
③ Set DATA LENGTH with the ◁ ▷ and △ ▽ keys. This value is common to both patterns A and B.

Select the digit to be set with the ◁ ▷ keys.

Set DATA LENGTH with the △ ▽ keys.
Set value: 128 to 4,194,304 bits (128-bit steps)



④ Set the number of pattern A loops with the △ ▽ keys.



Change the BIT value with the button below the LED. When LOGIC is positive, lighting of the LED indicates high level.

Used the PRESET ALL or PAGE key when changing DATA collectively.

PAGE 0 or 1 All BITs of the displayed PAGE are set to 0 or 1.

ALL 0 or 1 Pressing this key while holding down the GUARD key sets all BITs specified by DATA LENGTH to 0 or 1.

Next, set ② in pattern B (turn on the B LED) and set pattern B in the same way as pattern A.

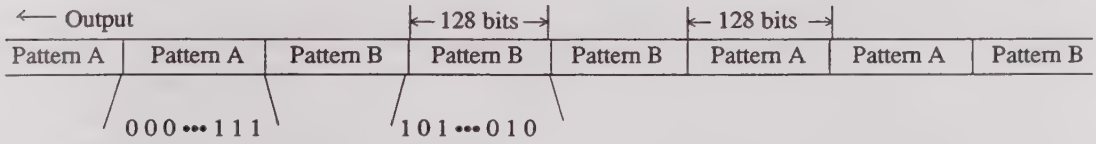
However, do not change DATA LENGTH here because it is shared by A and B. If DATA LENGTH is changed here, DATA LENGTH of pattern A is also changed.

Two patterns, A and B, can be set, and repetition times can be set for each pattern. The data lengths are the same for both patterns.

The following are examples of 128bit patterns:

Pattern A: 0 0 0 ••• 1 1 1 Repetition time: 2

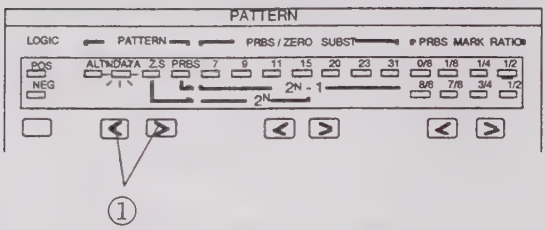
Pattern B: 1 0 1 ••• 0 1 0 Repetition time: 3



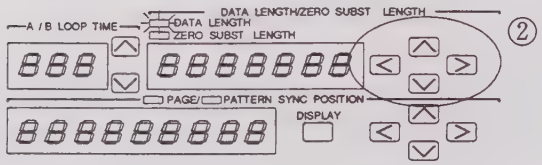
Bit 1 of page is set to the head of the pattern.

Note: The FUNCTION switch on the rear of the instrument can be set to switch between patterns A and B by an external signal. In this case, the A/B LOOP TIME display is turned off and the ▲ ▼ keys of ④ are disabled.

4.2.3 DATA pattern setting



① Select DATA with the ◁ ▷ keys.



② Set DATA LENGTH with the ◁ ▷ and △ ▽ keys.

Select the digit to be set with the ◁ ▷ keys.

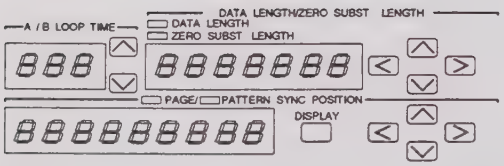
Set DATA LENGTH with the △ ▽ keys.

DATA LENGTH setting steps

2 to 65526: STEP 1 bit

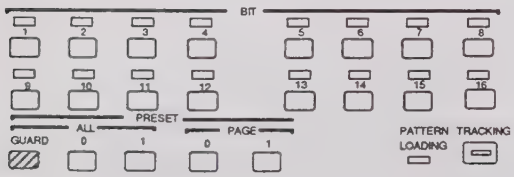
65536 to 131012: STEP 2 bits

See section 1.2, "Functions," for the following.



Set the page that is displayed at the BIT display with the set DATA LENGTH as 16 bits/page. BIT of the displayed page can be changed.

Setting value: 1 to DATA LENGTH/16
(LENGTH is multiple of 16)
1 to INT (DATA LENGTH/16)+1
(LENGTH is not multiple of 16)

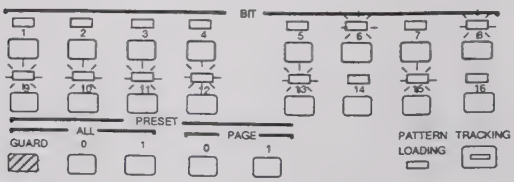


Change the BIT value with the button below the LED. When LOGIC is positive, lighting of the LED indicates high level.

Used the PRESET ALL or PAGE key when changing DATA collectively.

PAGE 0 or 1 All BITs of the displayed PAGE are set to 0 or 1.

ALL 0 or 1 Pressing this key holding down the GUARD key sets all BITs specified by DATA LENGTH to 0 or 1.



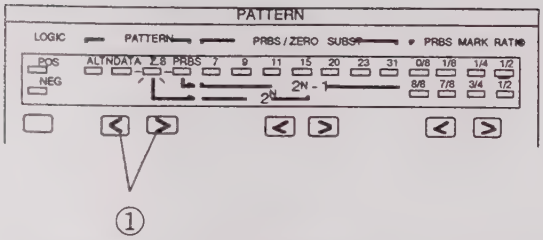
An optional pattern can be output repetitively.

When a 16-bit patern is set:

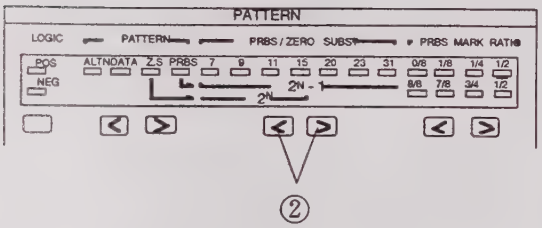
Pattern: 0000010111111010

111010	0000010111111010	00000101

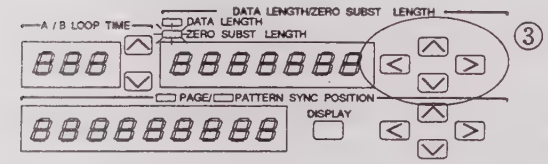
4.2.4 ZERO SUBSTITUTION



① Select Z.S. with the ◁ ▷ keys.



② Set the 2^N PATTERN with the ◁ ▷ keys. (This PRBS is a pseudo PATTERN with a period of 2^N.)



③ Set the ZERO SUBSTITUTION BIT LENGTH.

The pattern of bit length logic ø set here is substituted. See below for the substitution method.

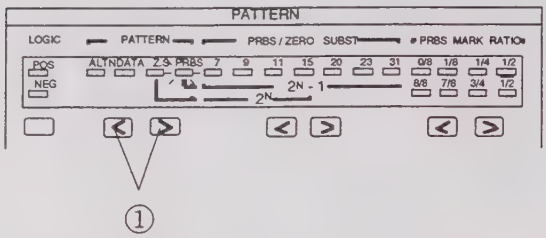
Setting: 1 to 2^N-1 (N=7, 9, 11 or 15)

A pattern in which one logical bit is added immediately before the longest string of consecutive 1s of a 7, 9, 11, or 15-step in a pseudo-PRBS (2^N bits: N=7, 9, 11 or 15) is substituted by an all-0s pattern. If the substituted bit is 0, this 0 is changed to 1.

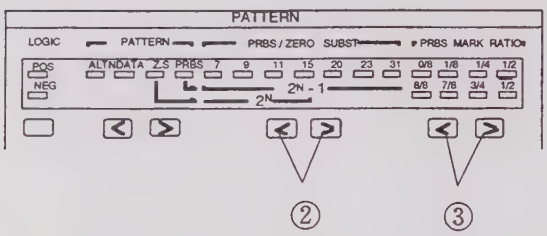
Example) In the case of a 7-step in a pseudo-PRBS
Since the longest string of continuous 0s is 7 - 1 = 6, the zero substitution starts at the next position.

```
                ←
        1000000|10000011000010 10 ..... ←— 7-step in a pseudo-PRBS
               |
               |↓
1 bit   1000000|010          ←——— Since the bit immediately after zero substitution is 0, it is changed to 1.
5 bits  1000000|000001 1     ←
7 bits  1000000|0000000 10
```

4.2.5 Pseudo random pattern setting



① Select PRBS with the ◁ ▷ keys.



② Set the number of PRBS steps with the ◁ ▷ keys.

③ Set the PRBS mark ratio with the ◁ ▷ keys.

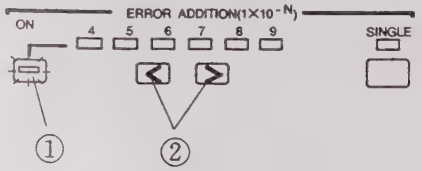
When LOGIC is positive, select the mark ratio from the top row (0/8, 1/8, 1/4, 1/2).

When LOGIC is negative, select the mark ratio from the bottom row (8/8, 7/8, 3/4, $\overline{1/2}$).

If change the logic positive to negative when mark ratio is 1/4, the mark ratio become 3/4.

Patterns generated as explained in Section 5.1 " Pseudo random patern". When an optional continuous N-bit pattern is selected in a PRBS pattern having a 2^N - 1 cycle, all bit paterns in the same cycle we unique. That is, all other bit arrays except all-1s are provided.

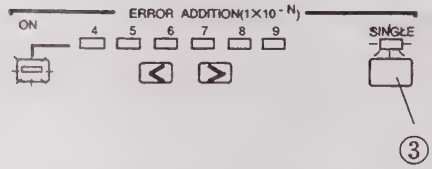
4.2.6 ERROR addition



① Press the key. The LED in the key lights.

② Select the error addition rate with the ◁ ▷ keys.

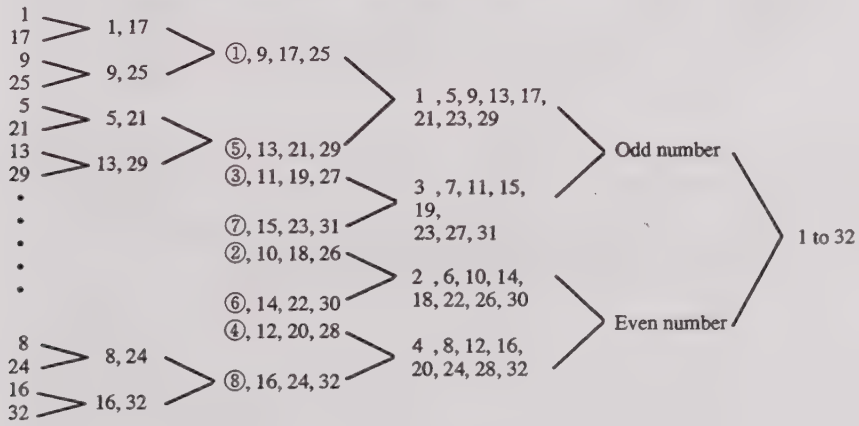
To add a single error, select the right of the 9 LED using the ▷ key. At this time, the LED does not go on.



③ The single error adds one error each time the key is pressed. The LED blinks each time a error is added.

Error addition can be inserted for one, and only one, of the 32 routes by using the rotary switch on the rear panel (see below). Therefore, the error multiplied by the output can be added to only one route of the output (1/8 OUTPUT).

Example) When a 1 x 10^{-4} error is added to one channel, following occurs:
1/8 OUTPUT: 1 × 10^{-4} × 8 (= 8 × 10^{-4}) error is added to DATA1.
No error is added to DATA2 to DATA8.

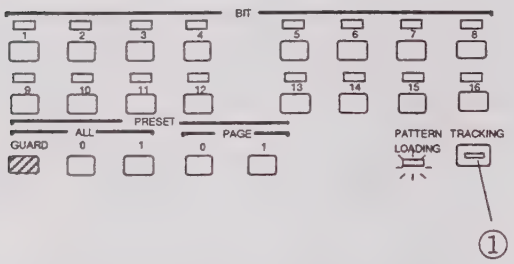


The numbers in circles (○) indicate the output order for 1/8 DATA OUT.

From the above drawing, in 1/8 OUTPUT, if the error insertion channel is 1, 9, 17, or 25, the error is inserted into 1/8 DATAOUT. If the error insertion channel is 5, 13, 21, or 29, the error is inserted into 1/8 DATAOUT 5.

Notes :
1. When the rotary switch is set to channel 00, an error is added to channel 1.
   When the rotary switch is set to channel 33 to 99, an error is added to channel 32.
2. When the FUNCTION switch on the rear of the instrument is set for external error injection, the error addition amount cannot be changed. However, the error addition ON/OFF key is enabled.

4.2.7 Tracking



① When the key is pressed, the LED inside the key lights and the instrument enters the tracking mode.

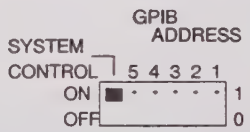
* When tracking, the MP1763B must be connected to an MP1764A by a GPIB.

When the PATTERN LOADING lamp lights, the data is read and the keys are disabled.

Tracking can be performed from both the transmitter and receiver. However, one of them must be set as the master. As a result, tracking cannot be performed concurrently from the transmitter and receiver.

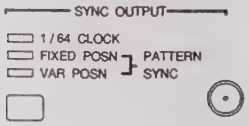
Turn on SYSTEM CONTROL of the Dip switch on the rear of the master instrument to perform tracking. (Turn off SYSTEM CONTROL of the controlled side.)

In addition, set GPIB ADDRESS of the controlled side to GPIB ADDRESS of the master side + 2.



When tracking is on, the setting of the transmitter (or receiver) is changed each time the setting of the receiver (or transmitter) set as the master is changed. Therefore, each time a key is operated on the master side, operation disabled state occurs . (Especially, operation is disabled for more than ten seconds when the bit length of the program is long.) To avoid this condition, turn off tracking before changing the setting of the master side.

4.2.8 Pattern SYNC. position



Select the sync output.

When VARIABLE POSITION is selected, set the SYNC OUT position as described in the following.

1/64 CLOCK, FIXED POSITION, OR VARIABLE POSITION can be selected.

1/64 CLOCK: 1/1 CLOCK is divided by 64.

FIXED POSITION: The sync pulse output fixed on page 1 of VARIABLE POSITION is generated.

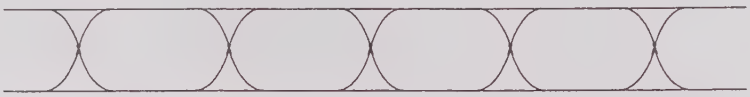
VARIABLE POSITION: The sync pulse position is shifted by 16 bits every time the PATTERN SYNC POSITION value is changed by one. The page numbers are changed by the PRBS step numbers, and all positions in one cycle can be selected by 16-bit interval.

PRBS	Value of PATTERN SYNC POSITION
2^7-1	$2^3 = 8$
2^9-1	$2^5 = 32$
$2^{11}-1$	$2^7 = 128$
$2^{15}-1$	$2^{11} = 2048$
$2^{20}-1$	$2^{16} = 65536$
$2^{23}-1$	$2^{19} = 524288$
$2^{31}-1$	$2^{27} = 134217728$

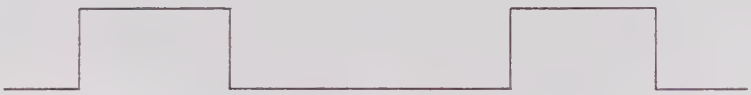
Switch DISPLAY to PATTERN SYNC POSITION, and set the PATTERN SYNC POSITIONS value.

When the PRBS DATA output is monitored on a sampling oscilloscope using each synchronization output, the following waveforms are shown:

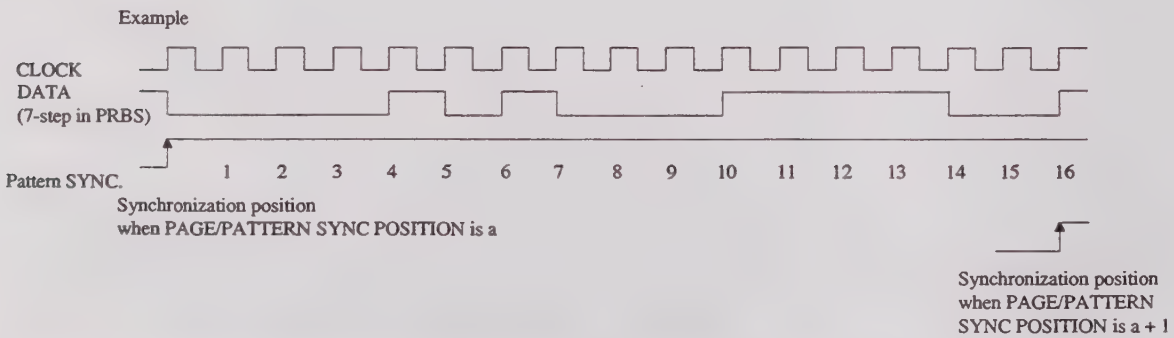
1) 1/64 CLOCK Shown as an eye pattern.



2) FIXED POSN and VAR POSN Shown as a 0 and 1 waveform.

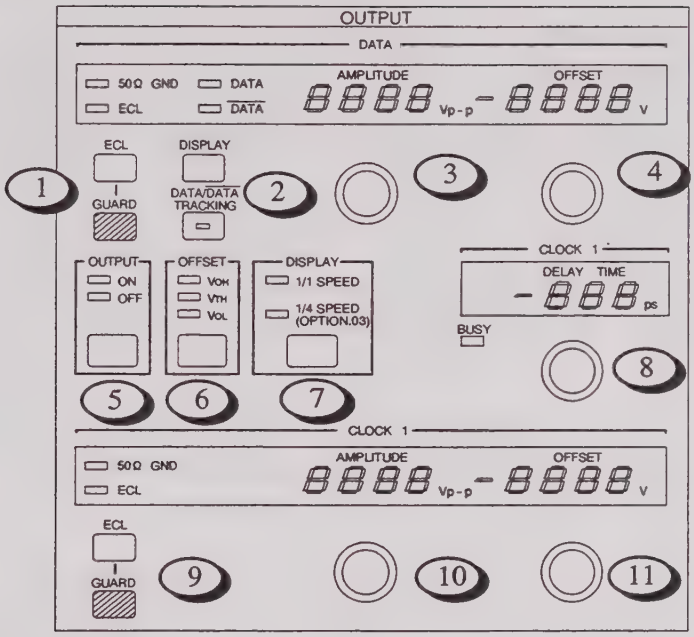


* At VAR POSN, the synchronization position shifts +16 (or -16) bits each time the PAGE/PATTERN SYNC POSITION value is incremented (or decremented) by 1.


Example
CLOCK
DATA
(7-step in PRBS)
Pattern SYNC.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Synchronization position when PAGE/PATTERN SYNC POSITION is a
Synchronization position when PAGE/PATTERN SYNC POSITION is a + 1

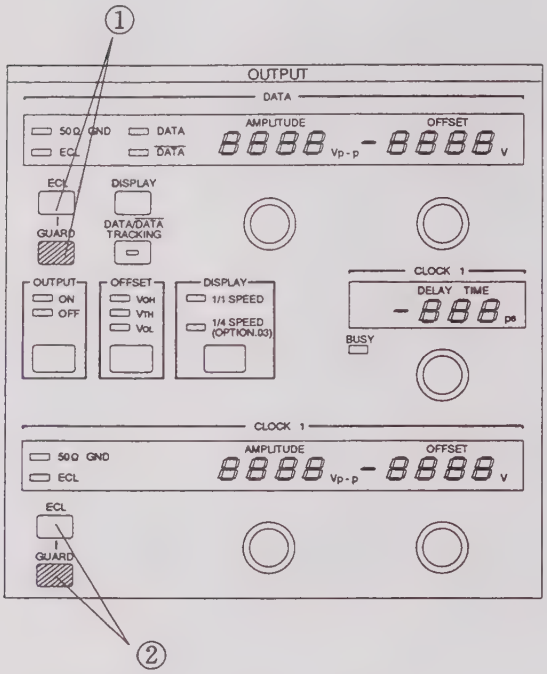
- The above figure is an example. Trigger output at the shown position is not specified.
- At FIXED POSN, the position is fixed to 1 of VAR POSN.

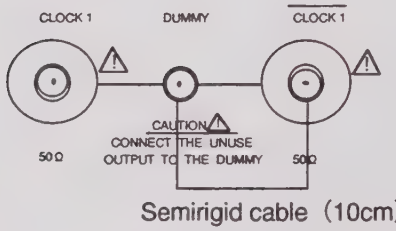
4.3 Output Interface



1. Termination conditions setting (DATA side)
2. DATA/$\overline{\text{DATA}}$ displaying switching and DATA/$\overline{\text{DATA}}$ tracking
3. Amplitude (DATA side)
4. Offset (DATA side)
5. Output ON/OFF
6. Offset display standard setting
7. 1/1 SPEED / 1/4 SPEED display switching
8. CLOCK delay
9. Termination conditions setting (CLOCK 1 side)
10. Amplitude (CLOCK 1 side)
11. Offset (CLOCK 1 side)

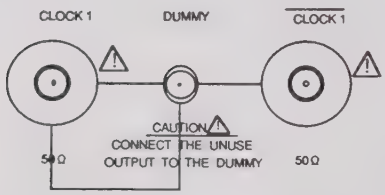
4.3.1 DUMMY terminal voltage switching





Semirigid cable (10cm)

When only CLOCK 1 output is used



When only $\overline{\text{CLOCK 1}}$ output is used

When only one of the CLOCK 1 and $\overline{\text{CLOCK 1}}$ complementary outputs is used, use the attached semirigid cable (10 cm) to connect the unused side to the DUMMY terminal.

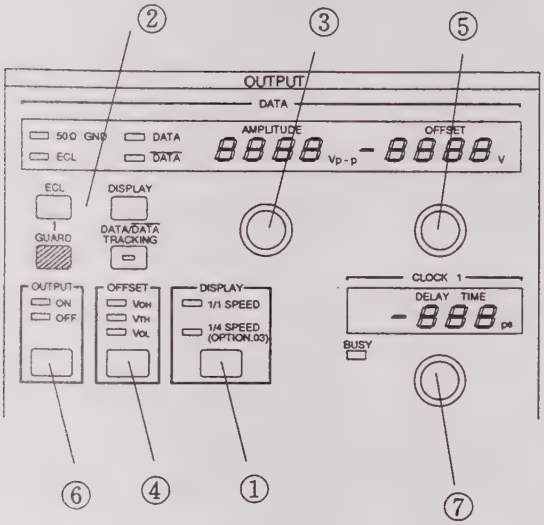
If the termination condition of the side used is 50Ω, and GND, press the ECL key while holding down the GUARD key of ② to turn on the 50Ω GND lamp and set the DUMMY terminal voltage to GND.

If the termination condition of the side used is ECL (50Ω, -2 V), press the ECL key while holding down the GUARD key of ② to turn on the ECL lamp and set the DUMMY terminal voltage to -2 V.

Notes:

1. When both outputs, match their termination conditions. (Setting one to 50Ω, GND termination and the other to ECL termination is not allowed.)
2. When only one output is used with 50Ω, and GND termination, the unused output can also be connected to a 50Ω terminator instead of DUMMY. However, only when one output is used with ECL termination, connect the unused output to DUMMY.
3. When the termination condition is switched from 50 Ω GND to ECL, amplitude 0.8Vp-p and offset -0.9V (V_{OH}) are automatically set.
4. Since the DATA and $\overline{\text{DATA}}$ outputs are in dependent, connection to the DUMMY terminal is unnecessary.

4.3.2 Amplitude, offset, and delay setting

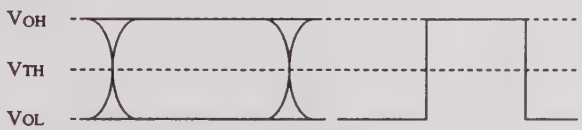


① When you want to set front panel DATA/$\overline{\text{DATA}}$ output and CLOCK 1/$\overline{\text{CLOCK 1}}$ output, switch to 1/1 SPEED. When you want to set rear panel 1/4 SPEED OUTPUT (OPTION), switch to 1/4 SPEED.

② Switches whether the DATA output or $\overline{\text{DATA}}$ output is set. When DATA/$\overline{\text{DATA}}$ TRACKING is turned on, the $\overline{\text{DATA}}$ output amplitude and offset become the same as the DATA output set value.

③ Set Amplitude to the desired value by turning the rotary encoder.

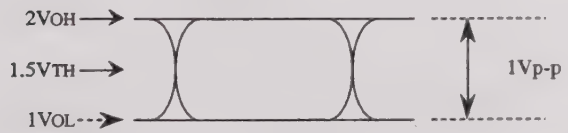
④ Set the offset standard value.



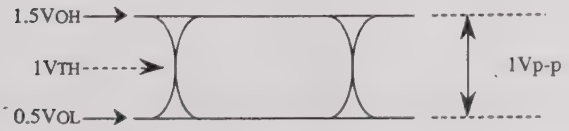
V_{OH}: Output 'High Level' is made the standard.
V_{TH}: The output level center value is made the standard.
V_{OL}: Output "Low Level" is made the standard.

⑤ Set the offset value. This value shows the value of the reference specified in ④.

The waveform is as follows when the amplitude is 1 Vp-p and the offset is 1 V_{OL}.

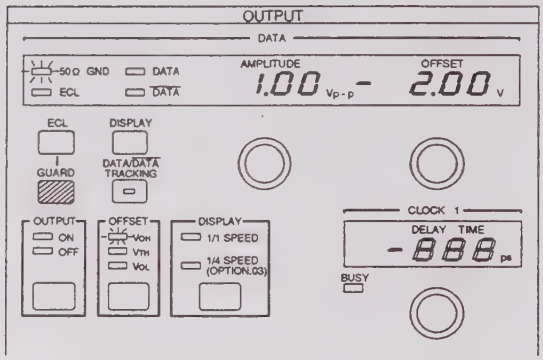


If the offset is changed to 1 V_{TH} in the above condition:

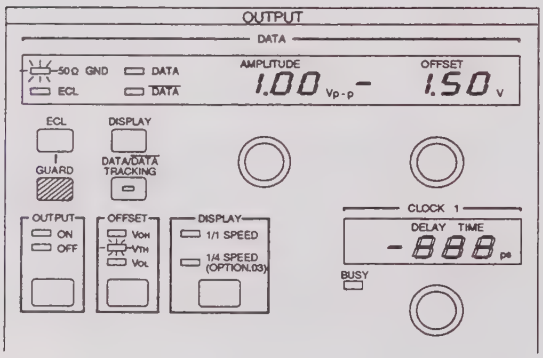


Set CLOCK in the same way. The offset reference is shared by DATA and CLOCK.

* When the setting of ④ is changed, the actual waveform and output do not change. Only the displayed value changes (see the figure below).

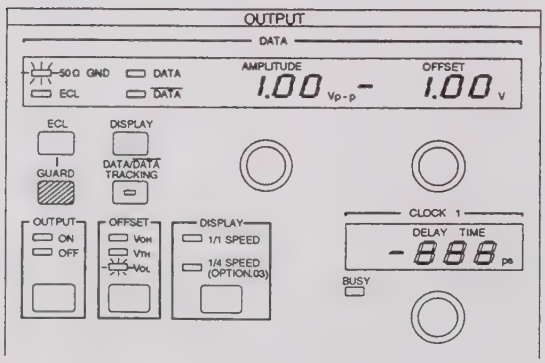


AMPLITUDE 1 Vp-p
OFFSEET 2 V_{OH}



If V_{OH} is changed to V_{TH}:

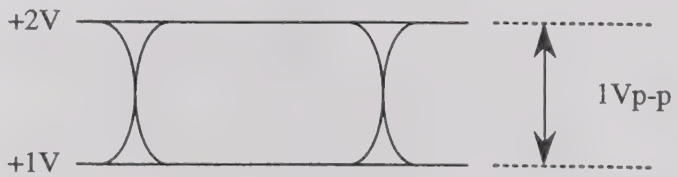
AMPLITUDE 1 Vp-p
OFFSEET 1.5 V_{TH}



If V_{OH} is changed to V_{OL}:

AMPLITUDE 1 Vp-p
OFFSEET 1 V_{OL}

The output waveform is as follows for any of the above three settings:



⑥ Set the output to ON.

Note 1: When output was turned off, the actual DATA, $\overline{\text{DATA}}$, CLOCK 1, $\overline{\text{CLOCK 1}}$, 1/4 DATA, and 1/4 CLOCK output amplitude becomes 0Vp-p, and the offset becomes 0V.

Note 2: Since the output circuit is not opened even when the output is turned off, do not apply an external voltage to the output terminals of this instrument.

⑦ Set the clock delay.

4.3.3 Duty adjustment

Fine adjustment of the CLOCK1/$\overline{\text{CLOCK1}}$ duty can be done using the control on the side of the instrument. The duty depends on the frequency, If the frequency is changed, monitor the waveform by sampling etc. and measure the duty again.

4.3.4 Cross point adjustment

Fine adjustment of the DATA,$\overline{\text{DATA}}$ cross point can be done using the control on the rear of the instrument.

4.3.5 Offset voltage setting range

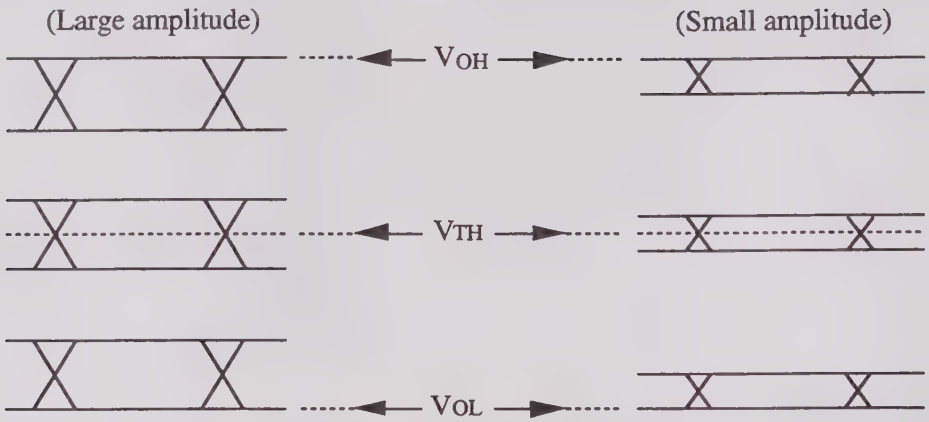


Fig. 4.3.5-1 Offset Reference Value and Amplitude Change

Note: Since the offset-voltage upper and lower limit values are limited by V_{OH} ($-2.0\ V \leqq V_{OH} \leqq +2.0\ V$), when V_{TH} or V_{OL} are set, the amplitude is limited at a certain value and may not change further.

Example: If V_{OL} is set at +1.00 V offset voltage and if there is a signal with amplitude 0.5 Vp-p added, that amplitude can only be increased to 1.0 Vp-p.

This is because their superposition after the increase would be meeting the maximum allowable level +2.00 V.

Figures 4.3.5-2 to 4.3.5-4 show the relationships between amplitude and offset-voltage settable ranges at three offset references.

• Offset reference: V_{OH}

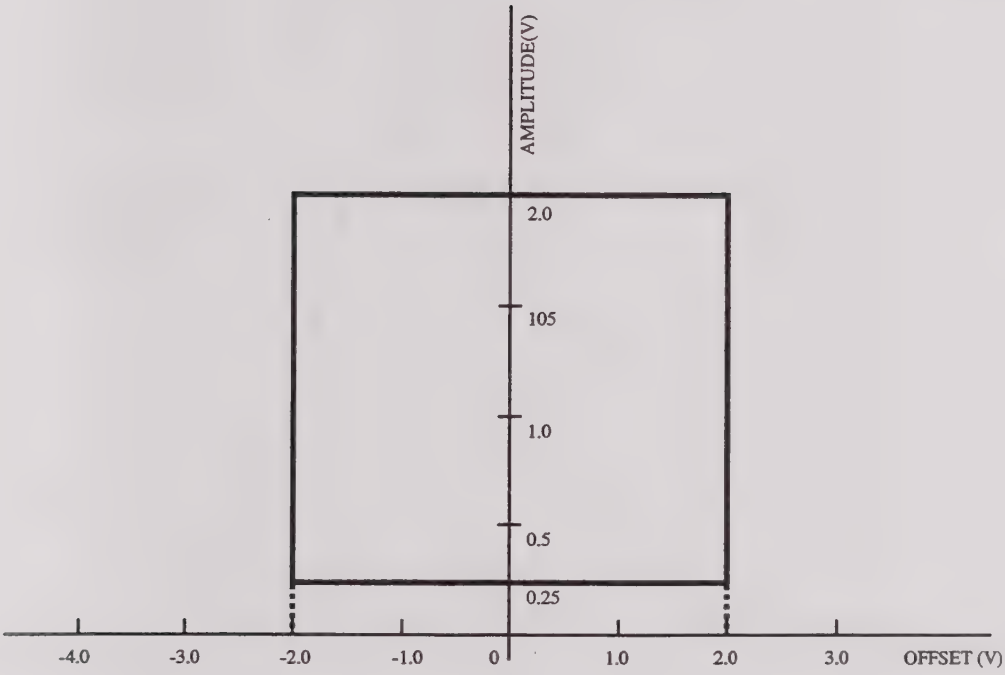


Fig. 4.3.5-2 Amplitude and Offset Voltage Setting Range Corresponding to Offset Reference Value

• Offset reference: V_{TH}

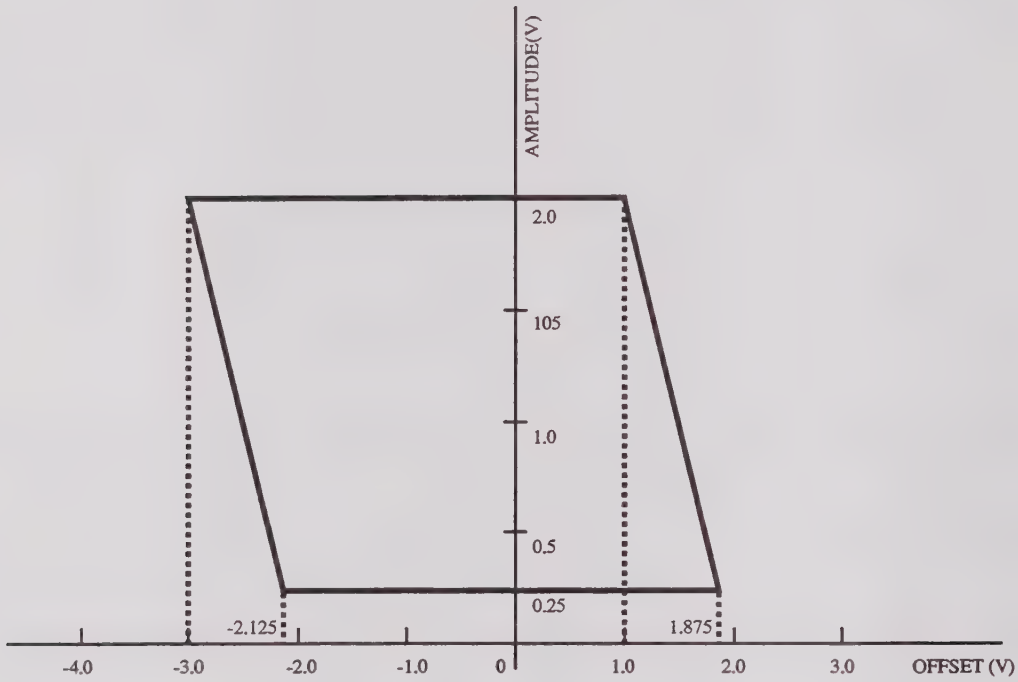


Fig. 4.3.5-3 Amplitude and Offset Voltage Setting Range Corresponding to Offset Reference Value

• Offset reference: VOL

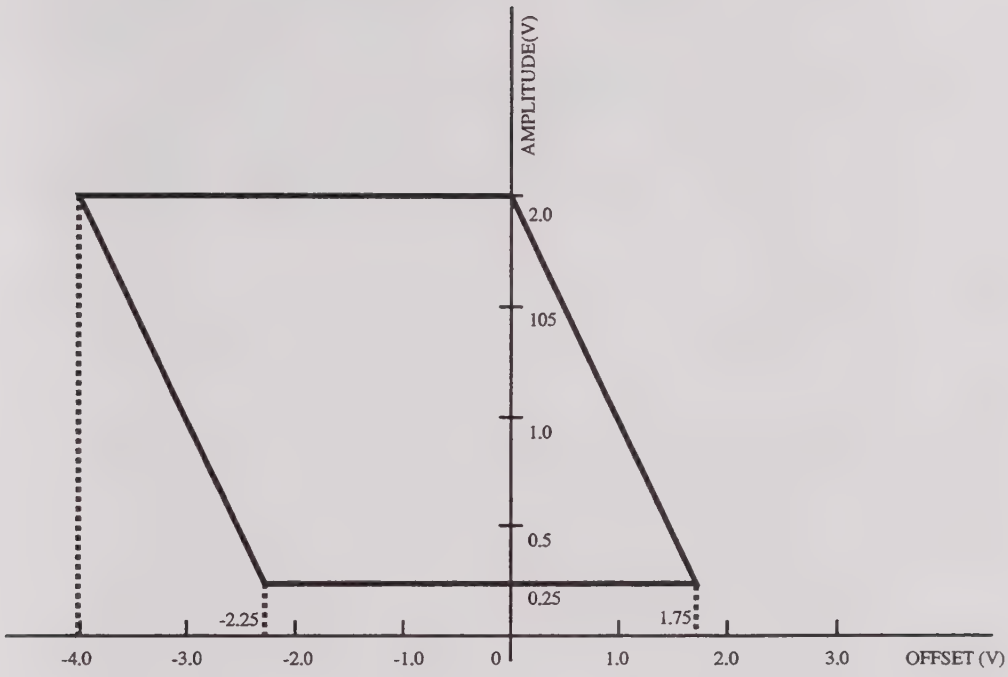
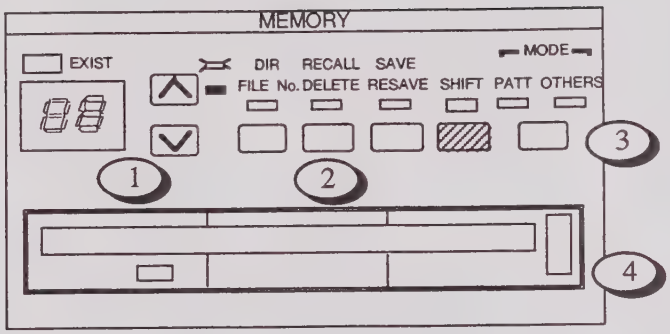


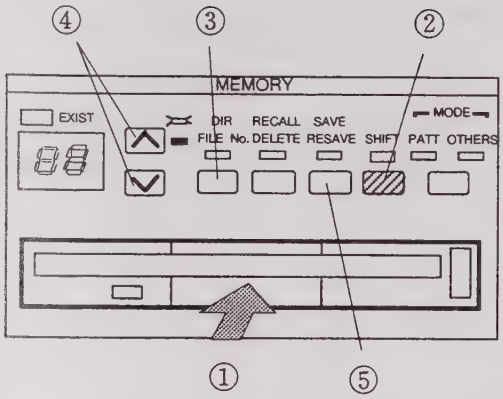
Fig. 4.3.5-4 Amplitude and Offset Voltage Setting Range Corresponding to Offset Reference Value

4.4 MEMORY (Floppy Disk)



1. File No. selection
2. File control
3. Mode selection
4. Eject

4.4.1 File save



① Insert a formatted floppy disk (2HD, 2DD) into the floppy disk drive. (For a description of how to format a floppy disk, see section 4.4.3 "Disk formatting".)

② Select the PATT or OTHERS mode.
PATT mode: The contents set at section 4.2 are saved.
OTHERS mode: Contents other than PATT are saved.

③ Light the File No. LED by pressing the DIR/File No. key.

④ Set the file name (00-99) with the ▲ ▼ keys.

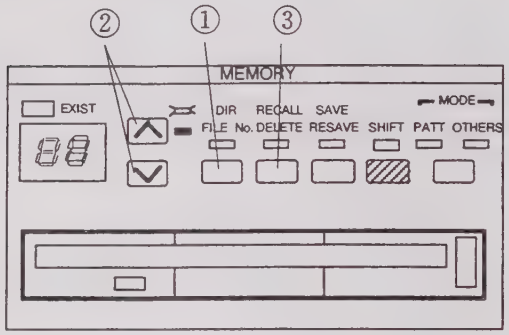
⑤ Save the file by pressing the SAVE key.

* If another file was previously saved under the same file name, the current file cannot be saved with the SAVE key. If the old file is unnecessary, a new file can be saved by pressing the shift key to switch to the shift mode, then pressing the SAVE key (resave). If the old file is necessary, change the file name and save the file.

Note: If the floppy disk does not have sufficient free space for the size of the file to be re-saved, the file cannot be re-saved. In this case, delete the file to be re-saved from the floppy disk.

A file larger than 720k cannot be re-saved to a floppy disk formatted as 1.44M.

4.4.2 File recall

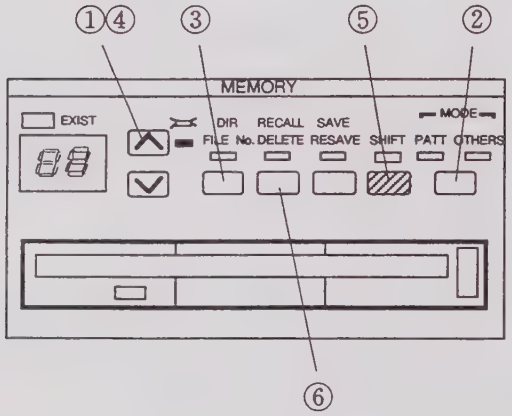


① Insert the floppy disk into the floppy disk drive and select the DIR mode. If the floppy disk is changed, always execute a DIR command.

② Check whither there is a file on the disk by pressing the [^][v] keys. If there is a file on the disk, only that file name is displayed. However, if there is no file on the disk, "– –" is displayed.

③ Call the contents of the file by pressing the RECALL key.

4.4.3 Disk formatting



① Insert a unformatted disk into the floppy disk drive.

② Don't care. (Both PATT and OTHERS mode are possible).

③ Select the FILE No. mode.

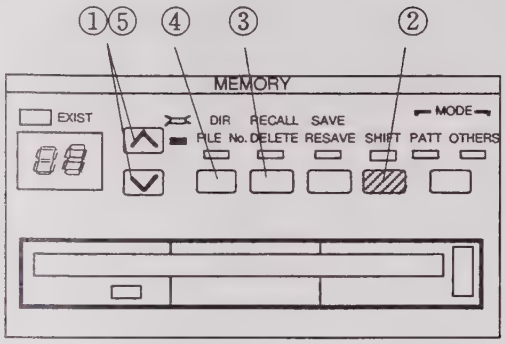
④ Display "Fr" by holding down the [^] key.
(Fr follows 99)

⑤ Select the SHIFT mode.

⑥ When the DELETE key is pressed, formatting begins.

Note: The FUNCTION switch on the rear of the instrument can be used for switching the format between 1440 KB/720 KB and 1232 KB/640 KB.

4.4.4 File deletion



① Insert the floppy disk into the floppy disk drive and select the file name to be deleted.

② Press the SHIFT key.

③ Delete the file with the displayed file name by pressing the DELETE key.

⑤ (Verification)
Execute a DIR command.

⑤ Verify that the file name deleted is not displayed by pressing the [^][v] keys.

4.4.5 Error messages

When a floppy disk error occurs, error codes E0 to E9 are displayed on the file name display. For the error codes, see Table 4.4.5-1 "Error Messages". An error message can be cleared by pressing the [^][v] keys.

Table 4.4.5-1 Error Messages

Error	Error contents
E0	Media error (formatting, media error)
E1	Write protection error (protection error when writing)
E2	File full (insufficient writing space)
E3	File not found (specified file not found when reading)
E4	File exists error (saving of same file attempted)
E5	Write error (write-disabled error)
E6	Read error (read-disabled error)
E7	File type, File error (file type or file contents error)
E8	FD error (other errors)
E9	Hardware error (hardware trouble error)

4.4.6 Floppy disk

(a) Disk type

The floppy disk is formatted in standard MS-DOS format provided by the MS-DOS file handler. The formatted floppy disk is data disk type. This is because the MS-DOS file handler does not copy the MS-DOS system.
A system disk containing the MS-DOS system can also be used to store data.

(b) Volume label

A volume label is added when the floppy disk is formatted.

Volume label: MP1761A

This volume label is provided to identify the floppy disk.

(c) File structure

- Directory structure

  Root directory only.
- File name, extender

  The file name and extender have the following format:

  File name TTXX
  ↑
  └— 00 to 99 (file name)

  Extender PTN: Pattern file
  OTH: Parameter file other than pattern file

  (Example) TT99.PTN
  TT01.OTH

(d) Data format

As a rule, the data stored on a floppy disk is not released.
Therefore, operation is not guaranteed even when data was generated and modified by using a personal computer controlled by MS-DOS. However, checking the file directory and copying of files are no problem.

(e) Compatiblity

It is possible for MP1763B PPG to use ' PTN ' file mode by MP1764A ED. ' OTH ' file is not used.
It is impossible for MP1763B to read file made by old type PPG, for example MP1701B, MP1608A and MP1650A.

4.4.7 Floppy disk precautions

- Do not remove a floppy disk from the floppy disk drive while it is being accessed.
- Observe the specified environmental conditions and do not use the floppy disk in dusty places.
- Do not place a magnetized object near the floppy disk and do not bend the floppy disk.
- Files saved by the MP1763B Pulse Pattern Generator cannot be loaded into other models.

4.5 Parameters initialization

When returning the pattern type, amplitude, offset voltage, and other parameters to the factory shipment state, turn on the power switch while pressing the LOCAL key.

This initializes the parameters. The initialization state is shown in Table 4.5-1.

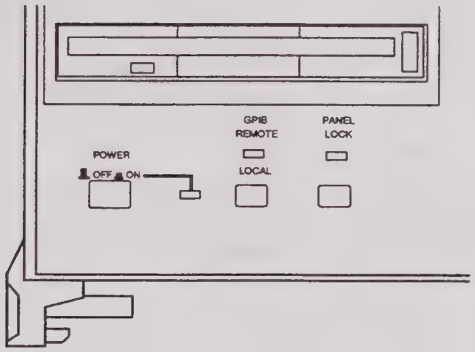


Table 4.5-1 Initialization State

Item	Initial setting
FREQUENCY	12, 500 MHz
TUNING	ON
MEMORY	00 (PTN mode, FILE NO. mode)
PATTERN	PRBS 2^{15}- 1, MARK RATIO 1/2
LOGIC	POS
ERR ADDITION	OFF
OFFSET	VOH
DATA TERM	GND
DATA AMPLITUDE	1.0 Vp-p
DATA OFFSET	0V
CLOCK TERM	GND
CLOCK AMPLITUDE	1.0 Vp-p
CLOCK OFFSET	0V
CLOCK DELAY	0ps
OUTPUT	OFF
DISPLAY	1/1 SPEED

4.6 Functions of the FUNCTION Switch

Table 4.6-1 lists the functions of the FUNCTION switch on the rear of the instrument.

Table 4.6-1 Functions of the FUNCTION Switch

SW	Item	Function
1	AND bit shift count for the mark ratio	0: 1 bit 1: 3 bits
2	External error injection	0: ON 1: OFF
3	Floppy disk format type	0: 1440/720KB 1: 1232/640KB
4	Alternate pattern A/B switching timing	0: INTERNAL 1: EXTERNAL

SECTION 5
PRINCIPLES OF OPERATION

5.1 Pseudorandom Pattern (PRBS Pattern)

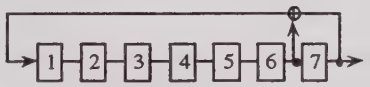
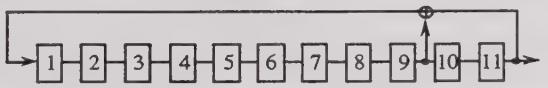
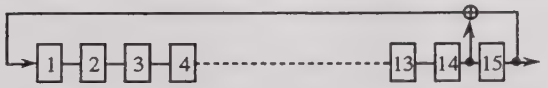
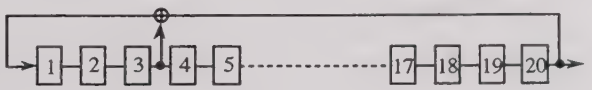
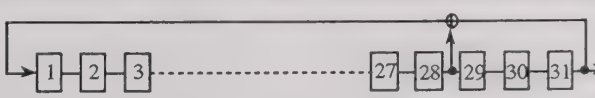
The principle of pseudorandom pattern generation is shown in Table 5.1-1. The pseudorandom pattern is represented by the Nth-order generation polynomial shown in Table 5.1-1. One period is 2^N-1. A PRBS pattern with a 2^N-1 period produces one N bits continuous "1" pattern per period.

When LOGIC is set to POS (positive logic), PRBS pattern output level "1" corresponds to low level and "0" corresponds to High level.

The PRBS pattern mark ratio is generated by the block shown in Fig. 5.1-1. There are four mark ratios of 1/2, 1/4, 1/8, and 0/8 (all 0). For 1/4 and 1/8, 1-bit shift or 3 bit shift can be selected using the Dip switch on the rear of the instrument, depending on the generation method (see section 4.6, "Functions of the FUNCTION Switch").

When the rear panel 1/8 SPEED output is a PRBS pattern, a pattern is produced train as shown in Fig. 5.1-2.

Table 5.1-1 Principle of Pseudorandom Pattern Generation

Period	Generation polynomial	Pattern generation block diagram
2^7-1	$1+X^6+X^7$	
2^9-1	$1+X^5+X^9$	
$2^{11}-1$	$1+X^9+X^{11}$	
$2^{15}-1$	$1+X^{14}+X^{15}$	
$2^{20}-1$	$1+X^3+X^{20}$	
$2^{23}-1$	$1+X^{18}+X^{23}$	
$2^{31}-1$	$1+X^{28}+X^{31}$	

N : Shift register

⊕ : Exclusive-OR

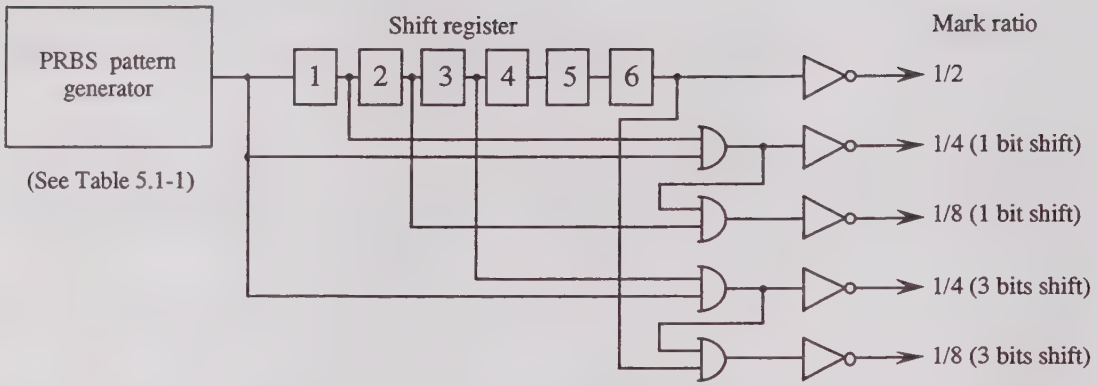


Fig. 5.1-1 Mark Ratio 1/4, 1/8 Pattern Generator

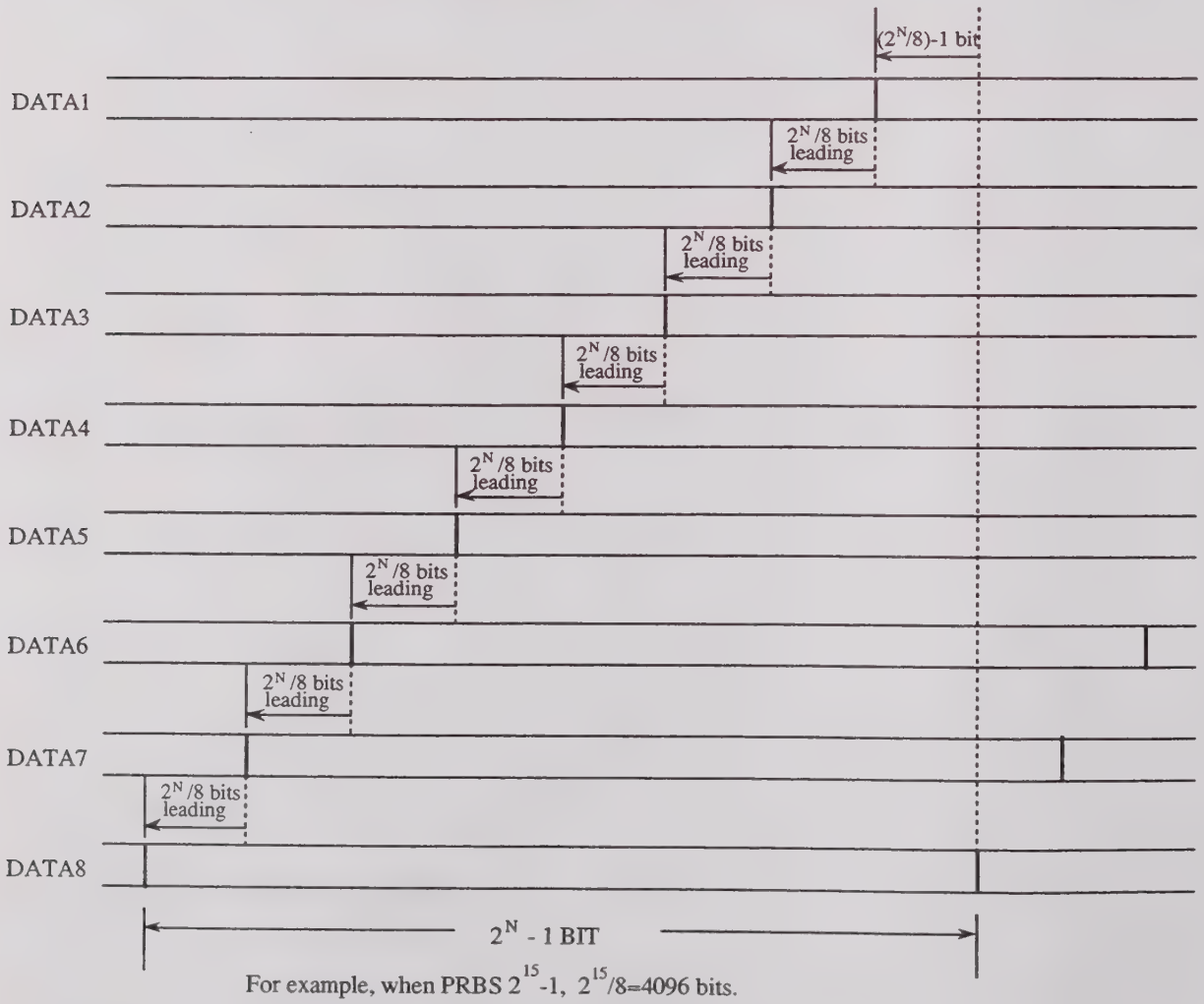


Fig. 5.1-2 Example of Pseudorandom Pattern

5.2 Pattern Synchronized Output Period

5.2.1 Pseudorandom pattern

$$\text{Period} = \frac{1}{\text{(set frequency)}} \times (2^N\text{-}1) \times 32$$

N=7, 9, 11, 15, 20, 23, 31

$$\text{(Where pulse width} = \frac{1}{\text{(set frequency)}} \times 32\text{, plus pulse)}$$

5.2.2 Programmable pattern

(1) Data pattern, alternate pattern

(a) Data length = 65536 or less

$$\text{Period} = \frac{1}{\text{(set frequency)}} \times \text{(least common multiple between 128 and data length)}$$

(Example 1) Data length = 8

$$\text{Period} = \frac{1}{\text{(set frequency)}} \times 128$$

(Example 2) Data length = 10

$$\text{Period} = \frac{1}{\text{(set frequency)}} \times 640$$

(b) Data length > 65536

$$\text{Period} = \frac{1}{\text{(set frequency)}} \times \text{(data length)}$$

(2) Zero sub pattern

$$\text{Period} = \frac{1}{\text{(set frequency)}} \times 2^N \qquad N=7, 9, 11, 15$$

(3) Pulse width

For any of the programmable patterns above, the pulse width $= \frac{1}{\text{(set frequency)}} \times 32$. The output signal polarity is plus pulse.

Note: For the alternate pattern, the synchronization output is output in basic data length units. As a result, when the data output is monitored on a sampling oscilloscope, patterns A and B are shown overlapping.

To prevent patterns A and B from overlapping, connect A/B TIMING OUTPUT on the rear of the instrument to the trigger of the oscilloscope through an ECL terminator.

SECTION 6
PERFORMANCE TEST

6.1 Test Equipment

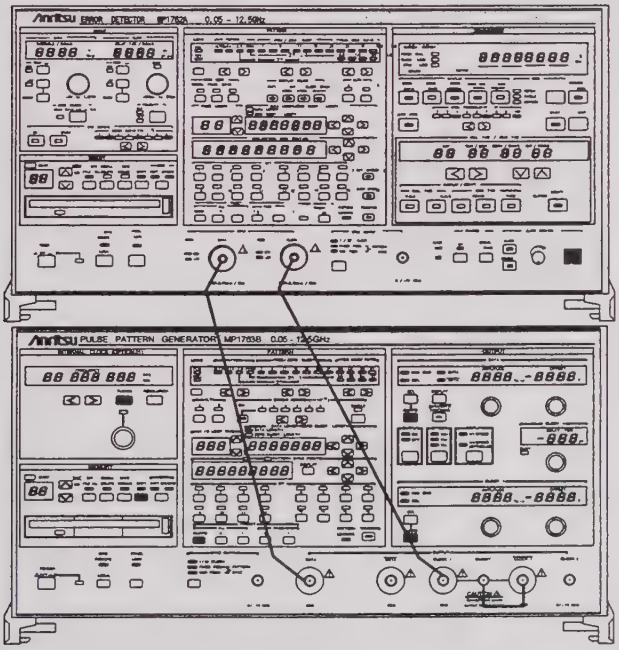
- Error detector (12.5 GHz or more measurement possible)
- Sampling oscilloscope (bandwidth 50 GHz or more)
- Clock generator (capable of covering the 0.05 to 12.5 GHz range)

  * no need when OPTION 01 is installed.

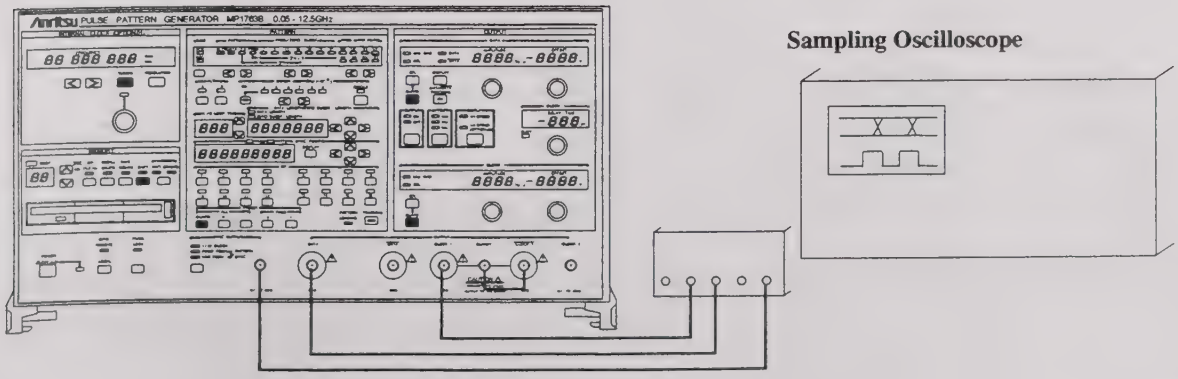
6.2 Error Measurement

Setup

(1) Error measurement setup



(2) Wave form monitor setup



6.3 Test Method

Connect the MP1763B DATA and CLOCK1 connectors to the error detector as shown in 6.2-(1).
Set Error Free at the setting shown below.

Pattern	LOGIC		POS
	PRBS		2^{31}-1
	Mark ratio		1/2
Output	DATA	amplitude	0.5 Vp-p
		offset	0 Vp-p
	CLOCK	amplitude	0.5 Vp-p
		offset	0.0 V_{OH}
		Delay	0 ps

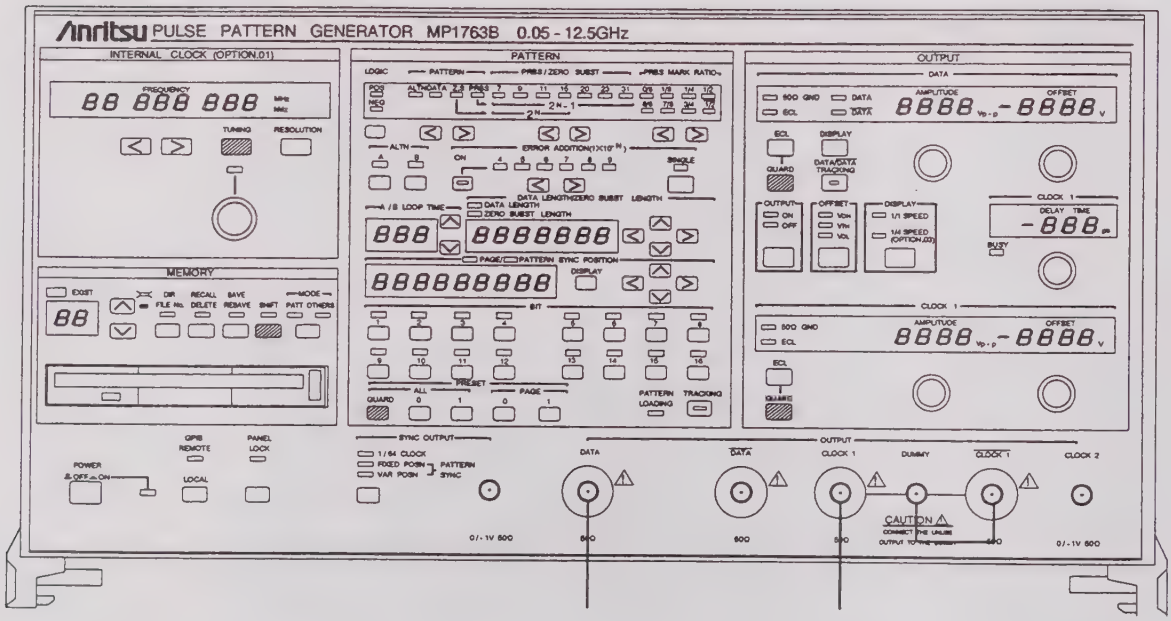


Fig. 6.3-1 Connection of front panel

Set the Error Detector to the same conditions as the MP1763B or set the margin to maximum. Confirm that the following points are Error Free:

Frequency	50 MHz, 1 GHz, 3 GHz, 5 GHz, 12.5 GHz
Amplitude	0.25 Vp-p, 2.0 Vp-p
Offset	0V_{OH}, -V_{OH}, +2 V_{OH}
Mark ratio	1/2, 1/8, 1/2, 7/8

Check $\overline{DATA}$ and $\overline{CLOCK1}$ in the same way. However, since CLOCK is inverted, invert the detector CLOCK polarity.

Check the 1/8 SPEED output with the connection shown at the below.

Pattern	LOGIC	POS
	PRBS	2^{31}-1
	Mark ratio	1/2

Check all the outputs with the connections DATA1 → DATA2 → - - - → DATA8.

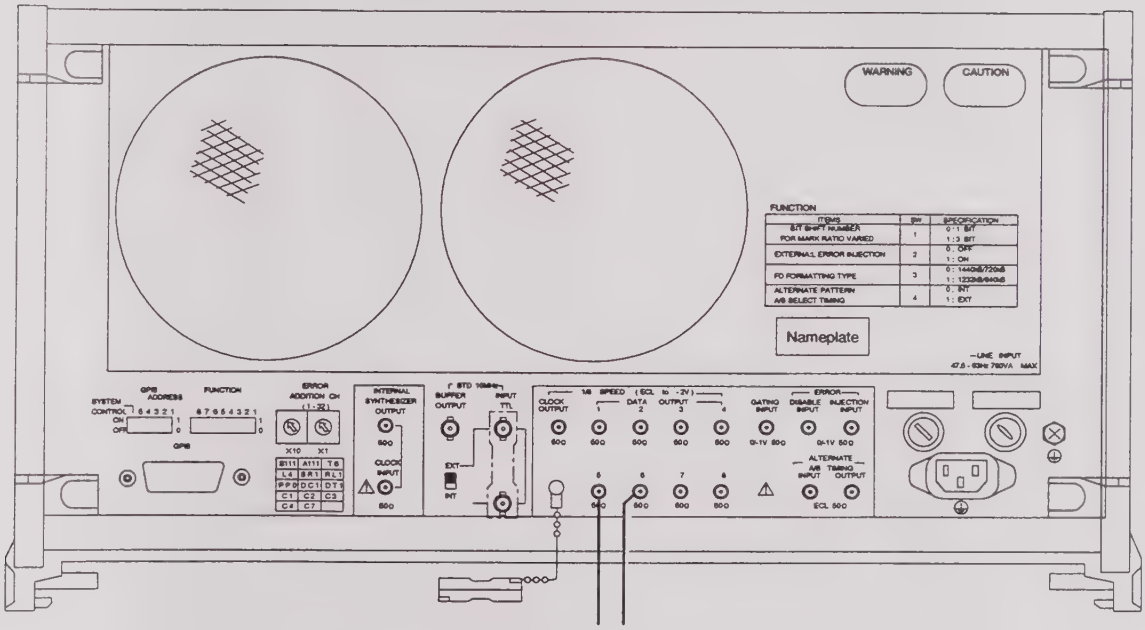


Fig. 6.3-2 Connection of rear panel

6.4 Waveform Check

Connect the MP1763B and sampling oscilloscope in accordance with 6.2-(2).

Check the DATA, $\overline{\text{DATA}}$, CLOCK, and $\overline{\text{CLOCK1}}$ waveforms.

Pattern	LOGIC		POS
	PRBS		2^{31}-1
	Mark ratio		1/2
Output	DATA	amplitude	2.0 Vp-p
	(CLOCK)	offset	0 V_{OH}

6.5 Check Items

Use a sampling oscilloscope to check that the amplitude, offset, raise, fall time, duty (CLOCK), and jitter (DATA) are within the specifications.

* When measuring the jitter, use the divided 1/1CLOCK as the sync trigger.

SECTION 7
CALIBRATION

This instrument cannot be calibrated except by the manufacturer. To guarantee performance, periodic calibration is recommended.

When a problem is encountered at the performance test described in the preceding section, please contact our Service Department.

SECTION 8
MAINTENANCE

8.1 Daily Maintenance

The daily maintenance method and maintenance period are shown in Table 8.1-1.

Table 8.1-1

Item	Period	Maintenance method
External dirt	• Before long-term storage	Wipe with a cloth dipped in a dilute neutral cleanser.
Adhesion of dust	• When used in a dusty place	Blow off with compressed air.
Loosening of parts installed with screws, etc.	• When detected	Retighten with the prescribed tool.

8.2 Preparation for Shipment

When shipping this instrument, if the packing material was saved when the instrument was unpacked, use it to repack the instrument. If the packing material was not saved, pack the instrument as described below. When handling the instrument, always wear clean gloves and handle it gently so that it does not get dented or otherwise damaged.

(a) Remove dirt and dust from the outside of the instrument with a dry cloth.

(b) Check that there are no loose or missing screws.

(c) Protect parts that protrude or may be easily deformed and wrap the instrument in a polyethylene sheet. Also wrap it in waterproofing paper, etc.

(d) Place the wrapped instrument in a cardboard box and seal the box with adhesive tape. Also consider the shipping distance, shipping means, etc. and place the instrument in a wood crate, as required.

SECTION 9
TROUBLESHOOTING AND REPAIR

9.1 Before Considering Trouble

If the instrument is not operating properly for some reason, check it as follows:

- **Power is not turned on**

  Is the power cord loose? → Plug in firmly.
  ↓
  Is the fuse blown? → Replace the fuse.

- **Synchronization is not established.**

  Are the transmit and receive interfaces the same? → Check the set values and set them to the correct values.
  (Termination conditions, output level, offset, etc.)
  ↓
  Is the connection cable normal? → Change the cable.
  ↓
  Initialize the instrument. (Transmitter and receiver)
  Set the receiver the same as the transmitter.

- **Error added**

  Is the cable loose? → Retighten the connector.
  ↓
  Is Error addition OFF? → Set Error addition to OFF.
  ↓
  Are the phase margin and bias margin sufficient? → Adjust so that the phase and offset are suitably cut.

- **The output waveform is distorted.**

  Is the cable loose? → Retighten the connector.
  ↓
  Is the $\overline{\text{CLOCK1}}$ outputs terminated? → use the attached cable to connect the outputs to the DUMMY terminal.
  ↓
  Are cables and connectors that have good high frequency characteristics being used? → Use cables and connectors that have good high frequency characteristics.

If the problem cannot be found from the above check items, contact the service section of Anritsu.

9.2 Fuse Replacement

Turn off the power switch, then disconnect the power cable plugged into the AC power inlet. Next, open the AC power fuse holder cover and replace the fuse with a spare.

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